AD-A154 316 EXPLORATION AND PRODUCTION OF HYDROCARBON RESOURCES IN COASTAL ALABAMA AND MISSISSIPPI(U) ARMY ENGINEER DISTRICT MOBILE AL NOV 84 COESAM/PD-EE-84-009 1/11

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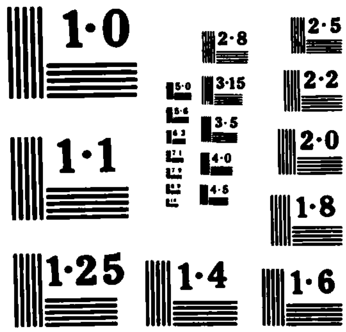

NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

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EXPLORATION AND PRODUCTION OF HYDROCARBON RESOURCES IN COASTAL ALABAMA AND MISSISSIPPI

FINAL GENERIC ENVIRONMENTAL IMPACT STATEMENT

LEAD AGENCY:

U.S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT

COOPERATING AGENCIES:

U.S. ENVIRONMENTAL PROTECTION AGENCY
U.S. FISH AND WILDLIFE SERVICE
NATIONAL MARINE FISHERIES SERVICE
ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
ALABAMA OIL AND GAS BOARD
MISSISSIPPI DEPARTMENT OF NATURAL RESOURCES
MISSISSIPPI DEPARTMENT OF WILDLIFE CONSERVATION, BUREAU OF MARINE RESOURCES
MISSISSIPPI OIL AND GAS BOARD

NOVEMBER 1984

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4. TITLE (and Subtitle) Final Generic Environmental Impact Statement for Exploration and Production of Hydrocarbon Resources in Coastal Alabama and Mississippi		5. TYPE OF REPORT & PERIOD COVERED Final 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U. S. Army Corps of Engineers, Mobile District		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Department of the Army Mobile District, Corps of Engineers P. O. Box 2288, Mobile, AL 36628-0001		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Same as No. 9		12. REPORT DATE November 1984 13. NUMBER OF PAGES 1127
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AD-A152060 - Ex Sum

18. SUPPLEMENTARY NOTES

See also AD-A152061

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Generic EIS
Corps of Engineers Permits
Hydrocarbon Permits
Alabama, Mississippi

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

An analysis has been undertaken of the physical biological and socioeconomic effects of hydrocarbon exploration and production activities in coastal Alabama and Mississippi and adjacent Federal waters of the Gulf of Mexico. The analysis consists of two parts: effects and generic unit actions, and cumulative effects of postulated hydrocarbon-related activities in the region over the next 30 years. Four subregions are considered in the analysis: the forested and seasonally-flooded Mobile-Tensaw River Delta, the shallow coastal

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

A154 316

estuaries of Mobile Bay and Mississippi Sound, and the Alabama and Mississippi state waters of the Gulf of Mexico.

Beneficial effects of hydrocarbon exploration and production activities would include some increase in regional employment and income, the receipt of bonus payments for leases, severance taxes and royalties by the states of Alabama and Mississippi, receipt of lease payments and royalties by private landowners, and an increase in the domestic production of natural gas, sulfur and oil. Other beneficial effects would be the creation of oyster habitat from shell pads placed at drilling locations in Mobile Bay and Mississippi Sound and space for attachment of fouling organisms on drilling/production platforms at all well sites.

The main short-term adverse environmental effects would be turbidity resulting from well site and pipeline construction activities, and the temporary loss of habitat and biological productivity during pipeline construction and during the drilling period at well sites that are eventually abandoned as dry holes.

Long-term adverse environmental effects include the reduction or loss of biological productivity and the alteration of habitat value at producing well sites and along wetland pipeline corridors, which would continue for many years until a well field is abandoned. The operation of drilling rigs, offshore production facilities, and onshore gas and oil cleaning and processing facilities would contribute to regional air pollutant emissions until the regional hydrocarbon resource is depleted. Loss of well control or rupture of a pipeline releasing oil could have an extensive effect on regional ecosystems and economies, depending on the size of the spill. Loss of well control or rupture of a pipeline releasing natural gas containing hydrogen sulfide could endanger human health and be harmful to plants and animals near the point of release.

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NOVEMBER 1984

FINAL

GENERIC ENVIRONMENTAL IMPACT STATEMENT

EXPLORATION AND PRODUCTION OF HYDROCARBON RESOURCES IN COASTAL ALABAMA AND MISSISSIPPI

The responsible lead agency is the U.S. Army Corps of Engineers, Mobile District, which has jurisdiction over permit applications for oil and gas activities in navigable waters and adjacent wetlands under the authority of Section 10 of the River and Harbor Act of 1899 and Section 404 of the Federal Water Pollution Control Act of 1972, as amended by the Clean Water Act of 1977.

Cooperating federal and state agencies include the U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, U.S. Geological Survey, National Marine Fisheries Service, Alabama Department of Environmental Management, Alabama Oil and Gas Board, Mississippi Department of Natural Resources, Mississippi Department of Wildlife Conservation, and Mississippi Oil and Gas Board.

Abstract: An analysis has been undertaken of the physical biological and socioeconomic effects of hydrocarbon exploration and production activities in coastal Alabama and Mississippi and adjacent federal waters of the Gulf of Mexico. The analysis consists of two parts: effects of generic unit actions, and cumulative effects of postulated hydrocarbon-related activities in the region over the next 30 years. Four subregions are considered in the analysis: the forested and seasonally-flooded Mobile-Tensaw River Delta, the shallow coastal estuaries of Mobile Bay and Mississippi Sound, and the Alabama and Mississippi state waters of the Gulf of Mexico.

Beneficial effects of hydrocarbon exploration and production activities would include some increase in regional employment and income, the receipt of bonus payments for leases, severance taxes and royalties by the states of Alabama and Mississippi, receipt of lease payments and royalties by private landowners, and an increase in the domestic production of natural gas, sulfur and oil. Other beneficial effects would be the creation of oyster habitat from shell pads placed at drilling locations in Mobile Bay and Mississippi Sound and space for attachment of fouling organisms on drilling/production platforms at all well sites.

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Long-term adverse environmental effects include the reduction or loss of biological productivity and the alteration of habitat value at producing well sites and along wetland pipeline corridors, which would continue for many years until a well field is abandoned. The operation of drilling rigs, offshore production facilities, and onshore gas and oil cleaning and processing facilities would contribute to regional air pollutant emissions until the regional hydrocarbon resource is depleted. Loss of well control or rupture of a pipeline releasing oil could have an extensive effect on regional ecosystems and economies, depending on the size of the spill. Loss of well control or rupture of a pipeline releasing natural gas containing hydrogen sulfide could endanger human health and be harmful to plants and animals near the point of release.

Additional information on this Final Generic Environmental Impact Statement may be obtained from:

Mr. Clay Carter
SAMOP-S
Mobile District
U.S. Army Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628
Commercial (205) 690-2658
FTS 537-2658

SUMMARY

Final Generic Environmental Impact Statement
on
Exploration and Production
of Hydrocarbon Resources
In Coastal Alabama and Mississippi

( ) Draft Environmental Statement (X) Final Environmental Statement

Responsible Office: U.S. Army Engineer District, Mobile
P.O. Box 2288
Mobile, Alabama 36628
Telephone: (205) 690-2511

1. Name of Action: (X) Administrative ( ) Legislative

2. Intent, Purpose and Need for the Generic Environmental Impact Statement: The District Engineer of the Mobile District, U.S. Army Corps of Engineers has determined that possible future development of hydrocarbon resources in the coastal areas of Alabama and Mississippi could potentially have a significant cumulative effect on the human environment, thereby requiring the preparation of an environmental impact statement under the provisions of the National Environmental Policy Act. The intent of the study is to identify and consider the environmental effects that could result if permits are requested from and issued by the District for hydrocarbon resource development projects in the study area. These effects are to be considered in conjunction with hydrocarbon resource development activities that could occur in contiguous federal waters. The cumulative effects identified in this document must be considered in deliberations by the District Engineer for future permit applications under the Authority granted the Corps of Engineers in Section 10 of the River and Harbor Act of 1899 and Section 404 of the federal Water Pollution Control Act, as amended by the Clean Water Act of 1977.

3. Environmental Analyses: Analyses have been undertaken of the physical biological and socioeconomic effects of hydrocarbon exploration and production activities in coastal Alabama and Mississippi and adjacent Federal waters of the Gulf of Mexico. The analysis consists of two parts: effects of generic unit actions, and cumulative effects of postulated hydrocarbon-related activities in the region over the next 30 years. Four subregions are considered in the analysis: the forested and seasonally-flooded Mobile-Tensaw River Delta, the shallow coastal estuaries of Mobile Bay and Mississippi Sound, and the Alabama and Mississippi state waters of the Gulf of Mexico.

a. <u>Unit Action Analyses:</u> A unit action is defined as a group of activities or sequence of events that occur together to complete a particular portion of a phase of hydrocarbon exploration and production. Some examples of unit actions are site preparation for a drilling alternative, well completion, gathering system construction, and gas treatment facility operation. The analysis is presented according to the four major phases of activities that take place: geophysical exploration, drilling, production, and abandonment. Reasonable alternatives available for carrying out the necessary activities within each phase have been considered.

Environmental loadings resulting from exploration and production activities have been determined for each unit action, and the generic environmental consequences of each activity are discussed. For example, the amount of benthic habitat disturbed by pipeline construction has been calculated an the generic effects of the disturbance of benthic communities discussed. However, the significance of this effect of the Mobile Delta, Mobile Bay, Mississippi Sound, or Gulf of Mexico ecosystem would depend on the total area altered at any time. This analysis is made in Chapter 8 (Environmental Consequences of Regional Resource Development scenarios). The unit action analyses serve as a basis for the cumulative effects determined in Chapter 8.

b. <u>Cumulative Environmental Effects of Regional Resource Development Scenarios:</u> The future environmental effects of oil and gas exploration and production activities in coastal Alabama and Mississippi will be a function of all the activities occurring together in the region at any time. In general, several activities will be occurring concurrently, such as drilling and production, and construction and operation activities. The amount and intensity of activity will be a function of the quantity of hydrocarbon resource that can be recovered, the timing of the leasing of public waters and private lands, lease exploration and development schedules established by the lease holders, and future factors affecting the hydrocarbon market.

The analysis is based on an estimate of the recoverable hydrocarbon resource in the region, scenarios for development of these resources, and the environmental loadings of the unit actions. The resource development scenarios establish upper and lower limits on the level of concurrent activities that could occur in each subregion over the next 30 years, based on certain assumptions about the timing of resource discovery and schedules of resource production. The development scenarios are not predictions of what will happen in the future; they merely establish limits within which future development is likely to occur.

The concurrent resource development activities per year are used to determine environmental alterations that could result from these activities. Several examples are habitat area disturbed over time, the effect of habitat disturbance on regional ecosystems, labor force required and the socioeconomic effect of the requirements, regional air and water quality alterations, and environmental and safety considerations of accidents.

4. Beneficial Environmental Effects: Beneficial effects of hydrocarbon exploration and production activities would include some increase in regional employment and income, the receipt of bonus payments for leases, severance taxes and royalties by the states of Alabama and Mississippi, receipt of bonus payments for leases and of royalties by private landowners and an increase in the domestic production of natural gas, other hydrocarbons and sulfur. Other beneficial effects would be the creation of oyster habitat from shell pads placed at drilling locations in Mobile Bay and Mississippi Sound and space for attachment of fouling organisms on drilling/production platforms at all well sites.

5. Adverse Environmental Effects: Any drilling in the Mobile Delta not undertaken from within a waterway would require the alteration of wetland area. Use of a canal and slip for well site access of an inland drilling barge would result in the complete loss of wetland area until the site is restored to original contours when the well site within the canal and slip is abandoned. All wetland values would be lost during this period. Alternatives utilizing platforms for drilling and canals or trestle roads for site access would reduce the amount of wetland area affected.

Pipeline rights-of-way in the Delta from well sites to upland facilities would also alter wetlands by removing all vegetation during pipeline construction. Regrowth of some vegetation would occur but larger woody vegetation would be removed periodically. Production or organic matter and habitat value would be reduced in rights-of-way for the active life of the pipelines.

Some temporary adverse affects could result in the Delta from turbidity that results from dredging of canals and slips, from construction of pipelines across channels if done by dredging, and from propwash of service boats.

In Mobile Bay, Mississippi Sound and the Gulf of Mexico benthic habitat would be affected temporarily at drilling sites and by pipeline construction. All biological productivity would be lost at disturbed sites during the construction period and would be reduced during the 1 or 2 year period of recovery after construction is completed.

Turbidity from construction activities in the Bay, Sound and Gulf could have some temporary biological effects. Oyster reefs and seagrass beds could be affected adversely if deposition of resuspended sediments from construction activities was great enough.

Operation of drilling rigs, offshore production facilities, and onshore gas and oil cleaning and processing facilities would contribute to regional air pollutant emissions until the regional hydrocarbon resource was depleted and the well fields abandoned.

Loss of well control or rupture of a pipeline releasing oil could have an extensive effect on regional ecosystems, commercial and sport fishing, and tourism. The extent of the effect would depend on the size of the spill.

Loss of well control or rupture of a pipeline releasing natural gas containing hydrogen sulfide could seriously endanger public health and safety and be harmful to plants and animals in the vicinity of the point of release.

6. Issues to be Resolved: Issues remaining to be resolved include the following:

Various alternative drilling methods using modular drilling rigs on platforms have been discussed for use in the Mobile Delta. While these drilling methods appear to be feasible, a cost comparison with standard inland drilling barge methods has not been undertaken.

7. Areas of Controversy: There are several areas of public concern regarding future hydrocarbon exploration and production activities in coastal Alabama and Mississippi. These include the effects of wetland disturbances from the use of canals and slips for drilling site access and for pipeline rights-of-way; the effects of activities on submersed aquatic vegetation, oyster reefs, and benthic communities of Mobile Bay and Mississippi Sound; the possibility of large spills of oil or condensate damaging the regional ecosystems and economies; and the risk to human health and safety that could occur from an accidental release of natural gas containing hydrogen sulfide.

8. The notice of availability for the Draft Generic Environmental Impact Statement was published in the Federal Register on May 4, 1984.

9. Letters of Comment on the Draft Generic Environmental Impact Statement and responses to them are given in Chapter 15.

10. The notice of availability for the Final Generic Environmental Impact Statement was published in the Federal Register

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CHAPTER 1

PURPOSE OF AND NEED FOR THE ACTIVITY

INTRODUCTION

1.1 Over the past several years, considerable interest has developed over the potential for the recovery of commercial quantities of oil and natural gas from geological formations beneath the coastal waters of Alabama and Mississippi. Leasing has taken place in both state waters and the contiguous federal waters of the Gulf of Mexico, mostly in Alabama waters and vicinity. The potential for oil and gas in formations underlying the Mobile River Delta in Mobile County, Alabama has also resulted in interest in exploration of this wetland area.

1.2 Because of the expected resource development activities that may occur in the region, the Mobile District of the U.S. Army Corps of Engineers, with the assistance of cooperating federal and state agencies, is preparing a generic environmental impact statement to evaluate the environmental issues associated with the anticipated hydrocarbon exploration and production from the lands underlying the Mobile River Delta, Mobile Bay, Mississippi Sound and adjacent state waters of the Gulf of Mexico. The location of these areas are shown on Figure 1-1 (end of chapter). The study area encompasses these areas and the counties of southern Alabama and Mississippi. Places frequently referred to in this study are shown on Figure 1-4 (end of chapter).

History of Oil and Gas Related Activities in the Study Area

1.3 Exploratory and production drilling has occurred around the study area since 1950 in Alabama and 1955 in Mississippi, with many fields producing commercial quantities of oil and gas (Figure 1-2, end of chapter). Recently, several fields were established in southern Baldwin County and are producing gas from relatively shallow formations. Although no fields are yet established in southern Mobile County, several wells have been drilled successfully to these same shallow formations and exploratory drilling continues.

1.4 Within the wetland and coastal waters under consideration in the study (Figure 1-1, end of chapter), drilling has occurred in the Mobile River Delta and in Mobile Bay. In the Delta region, early production centered on moderate depth formations on the northern and eastern edges of the Delta (the South Carlton and Tensaw Lake fields). Within the Delta, four exploratory efforts between 1963 and 1979 resulted in dry holes. In 1982, oil and gas were discovered in a deep formation in the Delta east of Mount Vernon (Mobile County, Alabama) and in early November, 1983, two

wells began producing commercial quantities of oil and gas. Within Mobile Bay, two unsuccessful wells were drilled in the mid-bay area in 1951-1952 and no further activity occurred until the 1978-1979 gas discovery in southern Mobile Bay.

1.5 Leasing in state waters of the study area was initiated in 1969 when Mobil Oil Corporation leased four blocks in southern Mobile Bay (Figure 1-3, end of chapter) (Raymond, 1982). Drilling of the first well on these tracts occurred in 1978 and 1979. Subsequently, development wells were drilled, and commercial recovery of natural gas from these tracts is expected to begin by late 1986.

1.6 Since Mobil's discovery, other tracts in the state waters of Alabama and Mississippi and in the contiguous federal waters had been leased. By mid 1984, several of these tracts in Alabama waters had been drilled. Tracts leased to date in the study region and vicinity are shown in Figure 1-3 (end of chapter). This includes the tracts leased in Alabama waters in August 1984.

Authority of the U.S. Army Corps of Engineers

1.7 The U.S. Army Corps of Engineers must assess the environmental effects of a project for which a permit is being requested before making a decision on denial or approval of the permit. Authority for this is derived from several sources, including the following:

- The River and Harbor Act of 1899.
- The National Environmental Policy Act of 1969.
- The Clean Water Act of 1977.
- Rules and Regulations of the Corps of Engineers, such as:
  - Regulatory Programs of the Corps of Engineers (33 CFR 320-330)
  - Environmental Quality: Policy and Procedures for Implementing the National Environmental Policy Act (33 CFR 230)

Specifically, Section 10 of the River and Harbor Act of 1899 prohibits the construction of any structure in or over navigable waters of the United States and prohibits the excavation from or depositing of material in such waters, or the accomplishment of any other work affecting the course, location, conditions, or capacity of such waters, unless the work has been authorized by the Secretary of the Army. Also, it is stated in Section 404 of the Clean Water

Act that the "Secretary [of the Army, acting through the Chief of Engineers] may issue permits, after notice and opportunity for public hearing for the discharge of dredged or fill material into the navigable waters at specified disposal sites."

1.7a To obtain permits for activities requiring them an applicant submits a form to the District office before beginning any work. Applicants furnish a detailed project description including drawings, lists of adjoining property owners and status of approvals or certifications required by other federal and state agencies. Once the application is received, it is acknowledged, processed and a public notice is issued. Normally, there is a 30-day comment period when federal, state and local agencies, individuals and special interest groups may review the application considering various environmental, and public interest factors. A public hearing may also be held during the 30-day period. All comments are then considered by the Corps in evaluating applications. If no serious objections or questions are raised, about 60 days are needed for the process. If the application is approved the applicant signs the document, returning it with a fee, and the permit is issued.

1.8 The Mobile District, Corps of Engineers has three administrative options available to it regarding the disposition of permit applications for structures and activities associated with oil and gas development projects. These are as follows:

- Grant a permit as requested.
- Grant a permit with restrictions or conditions.
- Deny a permit.

INTENT, PURPOSE AND NEED FOR THE GENERIC ENVIRONMENTAL IMPACT STATEMENT

1.9 The District Engineer of the Mobile District, U.S. Army Corps of Engineers has determined that possible future development of hydrocarbon resources in the coastal areas of Alabama and Mississippi could potentially have a significant cumulative effect on the human environment, thereby requiring the preparation of an environmental impact statement under the provisions of the National Environmental Policy Act (NEPA). The intent of the study is to identify and consider the environmental effects that could result if permits are requested from and issued by the District for hydrocarbon resource development projects in the study area. These effects are to be considered in conjunction with hydrocarbon resource development activities that [illegible] occur in contiguous federal waters. The cumulative effects identified in this document must be considered in deliberations by the District Engineer for future permit applications.

INDUSTRY PURPOSE AND NEED FOR HYDROCARBON RESOURCE DEVELOPMENT ACTIVITIES

1.10 The oil and gas industry has obtained mineral leases in the study area from the states of Alabama and Mississippi and from private individuals or organizations. In the contiguous federal waters, leases have been obtained from the U.S. government. It is likely that additional leases will be obtained in the future. The lease holders intend to determine if hydrocarbon resources exist on their leased tracts in commercially recoverable quantities. If so, they intend to recover the resource for sale to the public. To do so, the lease holders must erect structures for the drilling of wells and the production of the resource, lay pipelines to transport the resource, construct and operate resource cleaning and handling facilities, operate and maintain facilities for servicing the drilling and production sites, and dispose of waste products resulting from these operations.

1.11 Lease holders must obtain permits for their activities from the Corps of Engineers and other federal, state and local governmental organizations. The information contained in the Generic Environmental Impact Statement will assist the District Engineer in making timely and responsible decisions on permit requests for the exploration and production of hydrocarbon resources in the coastal waters and wetlands of the Mobile District.

PUBLIC PURPOSE AND NEED FOR HYDROCARBON RESOURCE DEVELOPMENT ACTIVITIES

1.12 There has been much public concern during the past decade regarding the extent to which the United States is dependent on foreign sources of petroleum hydrocarbons. This has increased awareness of the need to find and utilize domestic sources of hydrocarbons. The recovery of hydrocarbons from the study area would contribute to the domestic store of this resource, enhance the national defense posture of the United States by reducing dependence on foreign sources of hydrocarbons, improve the U.S. balance of trade and provide employment and income to the region.

1.13 The District Engineer must consider the environmental effects of oil and gas activities requiring permits from the Mobile District. These effects are discussed for the public record in the Generic Environmental Impact Statement and public comments are considered in preparing the document. This process assures that the need to develop hydrocarbon resources is considered in the context of the need to protect environmental resources.

REGULATORY PROCEDURE DURING PREPARATION OF THE GENERIC ENVIRONMENTAL IMPACT STATEMENT

1.14 During the period of time necessary to complete the generic environmental impact statement process the District will continue to accept and process permit applications for hydrocarbon exploration and production in the study area. Decisions on the applications will be based on the overall public interest review at that time and will not be delayed solely because of the ongoing development of the environmental impact statement.

1.15 Permit applications received by the District will continue to be processed on an individual basis. For each application, as is necessary, a public notice will be issued providing opportunity for the public to request a public hearing or to comment on the proposal; the District will prepare an environmental assessment of the proposal to determine if there are potential significant environmental impacts that would require the preparation of a site-specific impact statement. The District will also send the proposal to the appropriate agencies for their review.

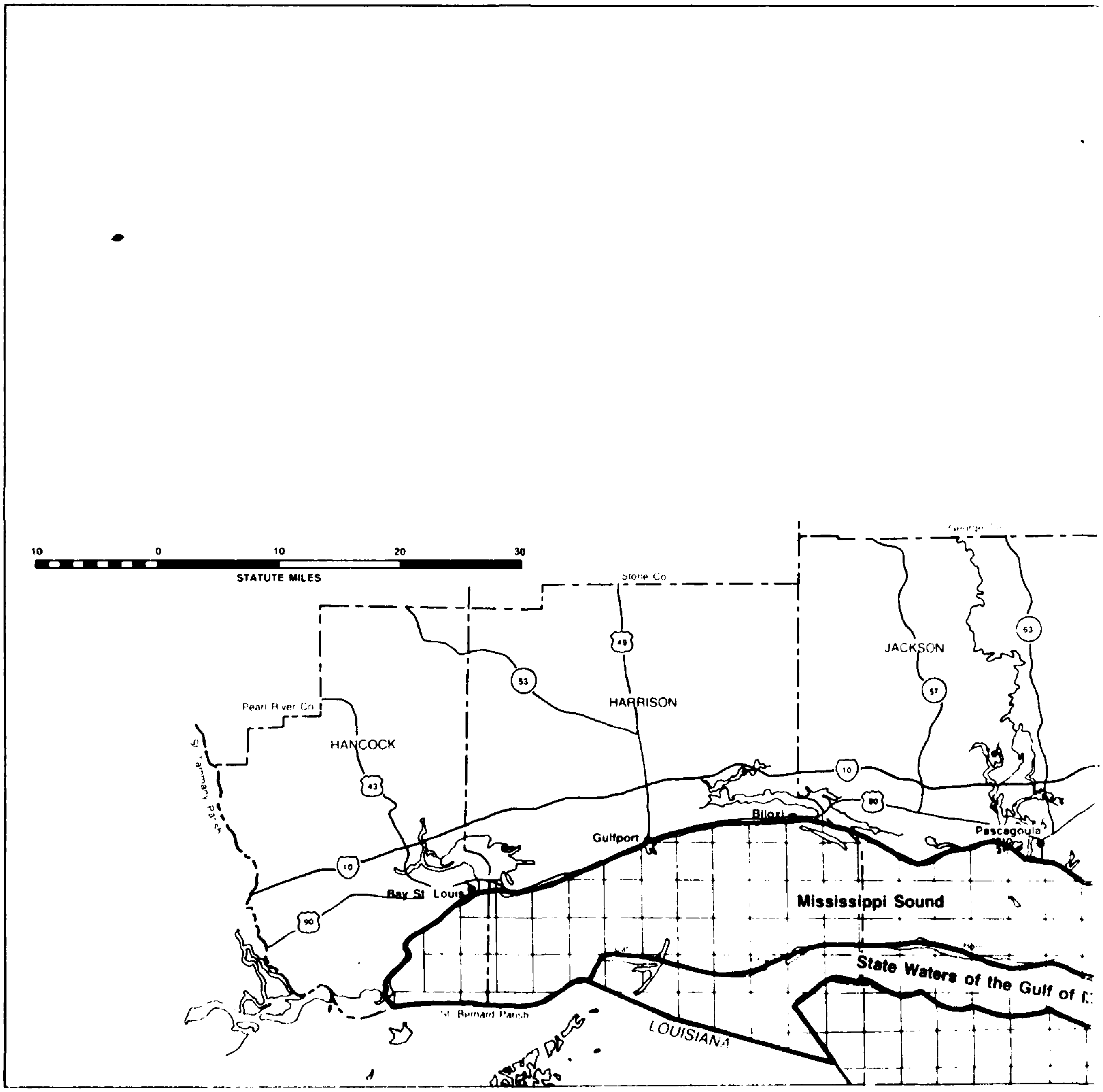
1.16 If the District Engineer determines that a project for which a permit has been requested has the potential for significant effects upon the quality of the human environment and it is believed that issuance of a permit may be warranted, then an environmental impact statement will be prepared to address that specific permit request. This impact statement may be a part of the ongoing generic environmental impact statement, a supplement to the generic environmental impact statement or a separate impact statement on its own merits. If no significant impacts are suspected, then the site-specific request will continue to be processed based on the results of the environmental assessment.

COOPERATING AGENCIES PREPARING THE GENERIC ENVIRONMENTAL IMPACT STATEMENT

1.17 The Generic Environmental Impact Statement has been prepared by the following cooperating agencies:

U.S. Army Corps of Engineers, Mobile District
U.S. Environmental Protection Agency, Region IV
U.S. Fish and Wildlife Service
National Marine Fisheries Service
Alabama Department of Environmental Management
Alabama Oil and Gas Board
Mississippi Department of Natural Resources
Mississippi Department of Wildlife Conservation
Mississippi Oil and Gas Board

1.18 The U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency prepared the document with assistance of consultants. The other cooperating agencies contributed information as needed during the preparation of the preliminary draft and through review and comment on the preliminary draft. The U.S. Environmental Protection Agency was responsible for analyses of water quality, air quality, noise, solid and hazardous wastes, and the physical aspects of spills and loss of well control. The Corps of Engineers was responsible for all other analyses (see Chapter 14).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STATUTE MILES
Stone Co
Pearl River Co
HANCOCK
HARRISON
JACKSON
St Tammany Parish
10
90
43
53
49
57
63
Bay St Louis
Gulfport
Biloxi
Pascagoula
Mississippi Sound
State Waters of the Gulf of
St Bernard Parish
LOUISIANA

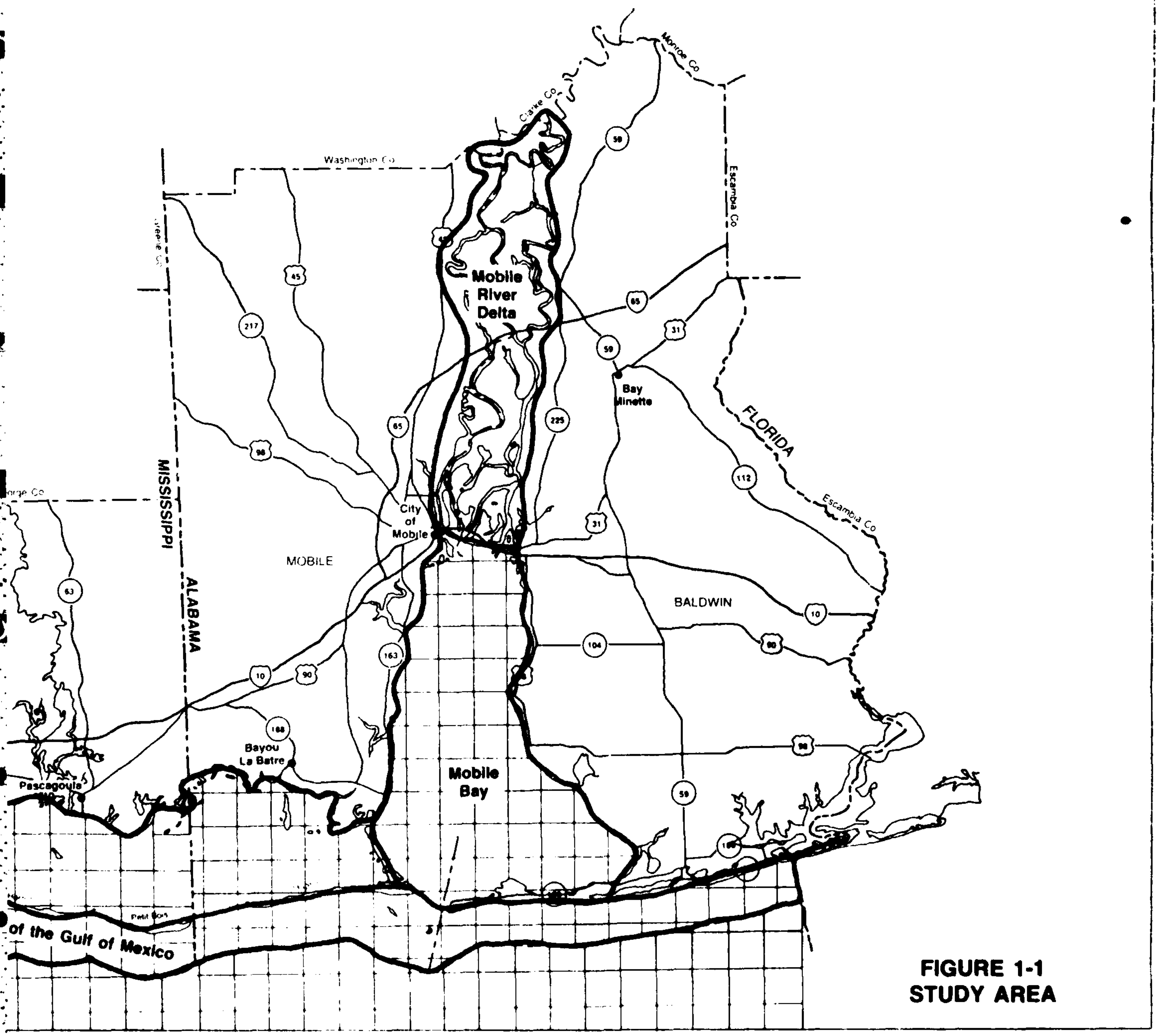


FIGURE 1-1
STUDY AREA

MISSISSIPPI

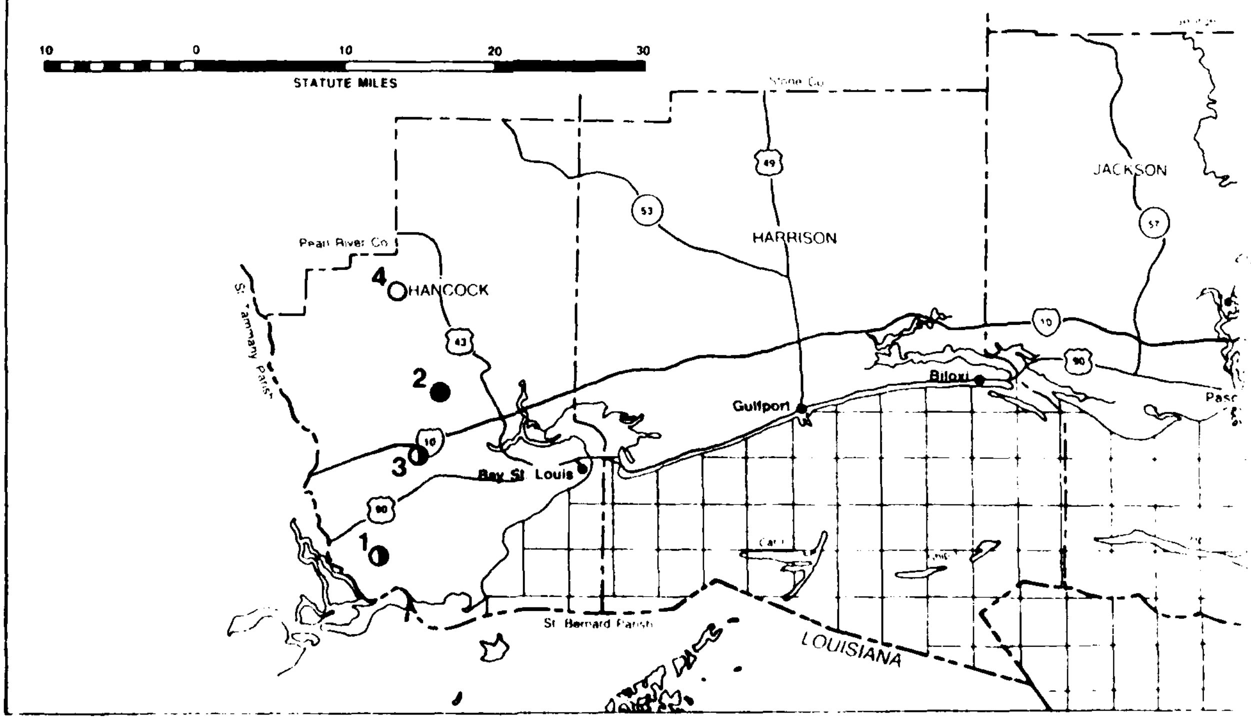
1. Ansley - 1955(A), 1981
2. Kiln - 1959(A)
3. Waveland - 1965,1977,1978
4. Catahoula Creek - 1981

ALABAMA

1. South Carlton - 1950
2. Citronelle - 1955
3. Tensaw Lake - 1965(A)
4. Chunchula - 1974
5. Hatter's Pond - 1974
6. South Cold Creek - 1975
7. Cold Creek - 1978
8. Foley - 1979
9. Lower Mobile Bay - 1979
10. East Oyster Bay - 1980
11. Blacksher - 1980
12. South Weeks Bay - 1980
13. West Foley - 1981,1982
14. Skunk Bayou - 1981(A)
15. Little River - 1981
16. Pleasant View - 1982
17. Movico - 1982
18. South Foley - 1982
19. Cypress Point - 1983
20. Gulf State Park - 1984

A - Abandoned
● - Oil
◐ - Gas Condensate
○ - Dry Gas

Source: Bolin and Masingill, 1983; Luper, 1983; Mink, 1984; Mississippi State Oil and Gas Board, 1982b, 1983.



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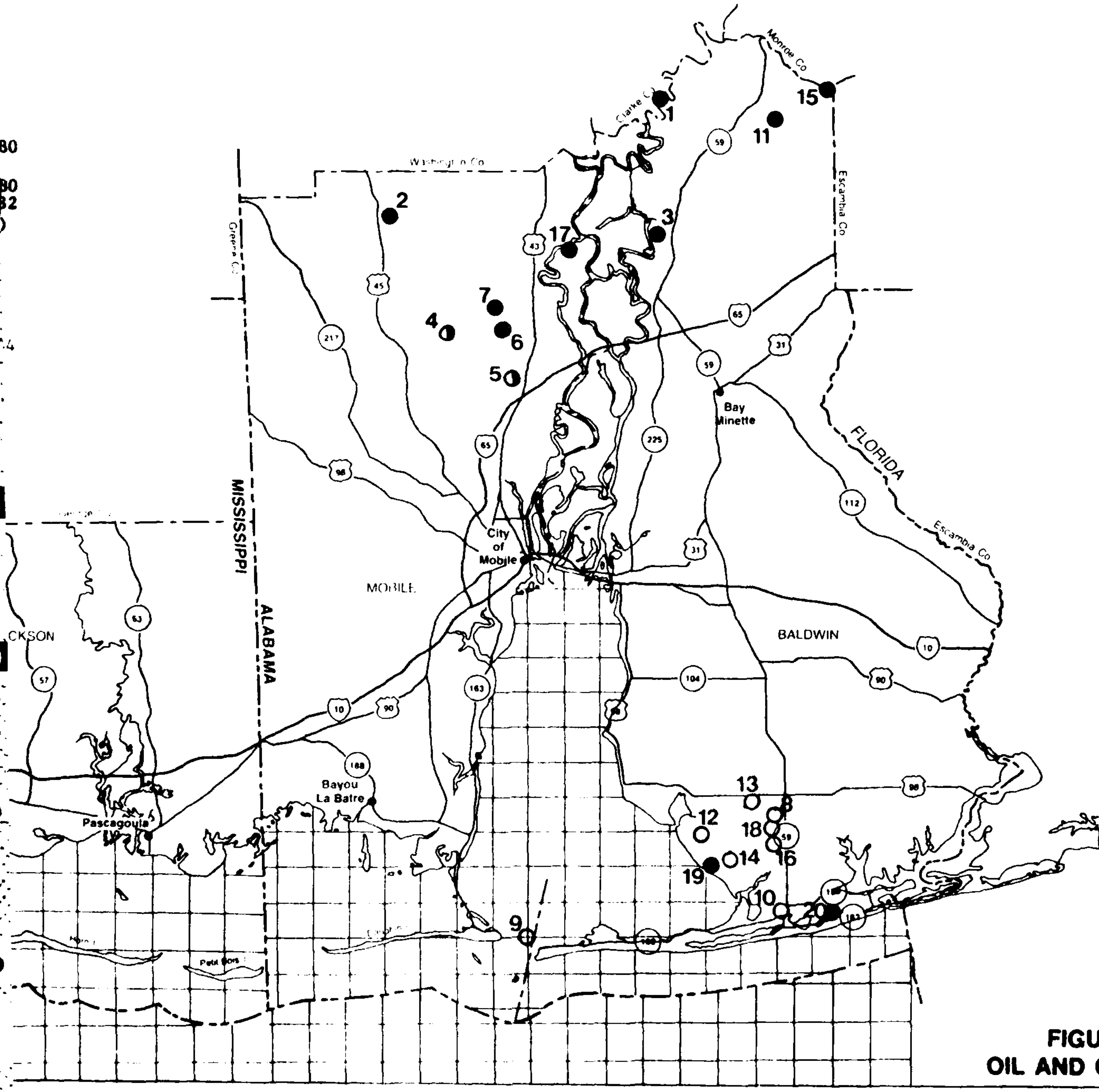

FIGURE 1-2
OIL AND GAS FIELDS

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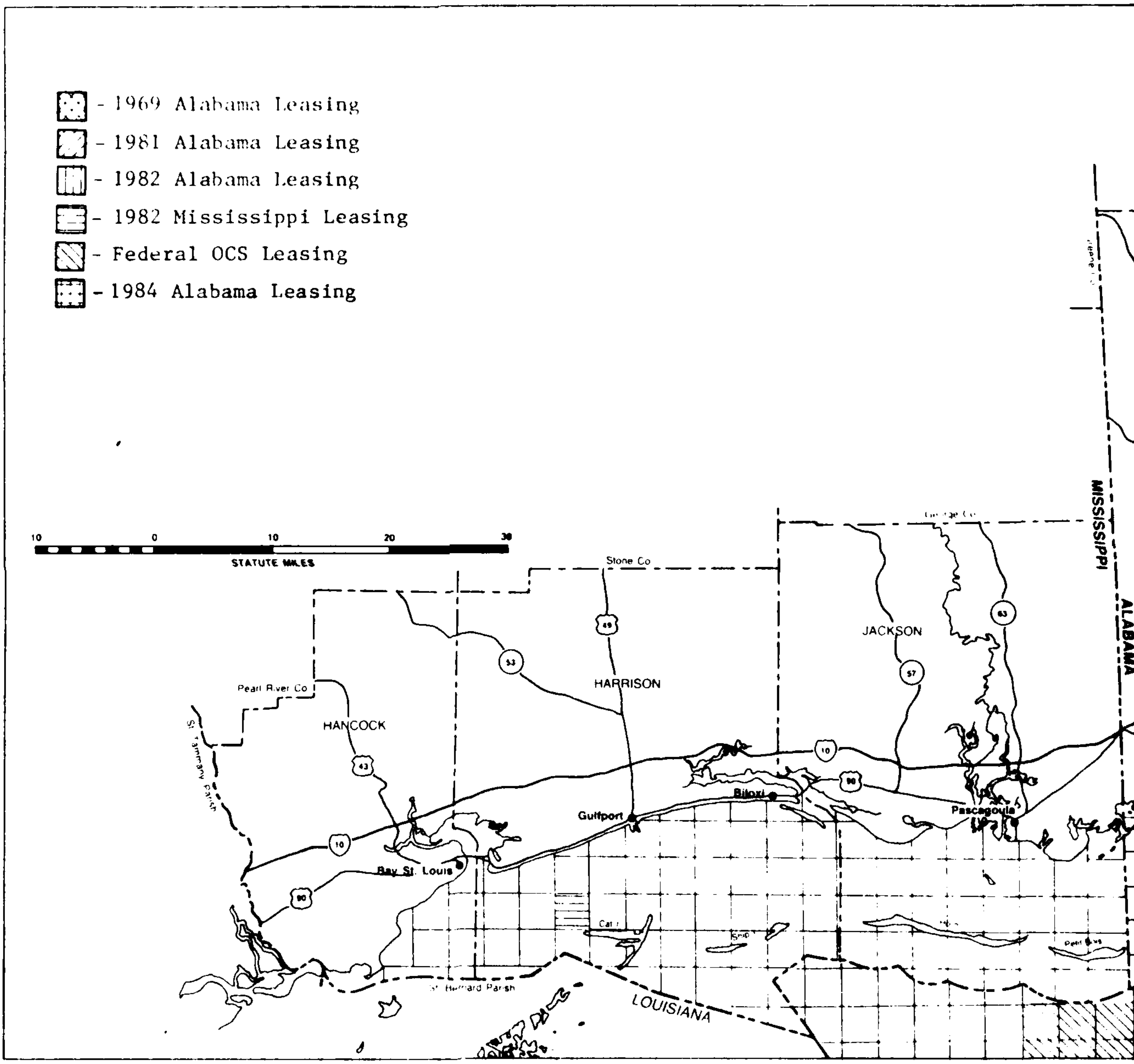
- 1969 Alabama Leasing
- 1981 Alabama Leasing
- 1982 Alabama Leasing
- 1982 Mississippi Leasing
- Federal OCS Leasing
- 1984 Alabama Leasing
10
0
10
20
30
STATUTE MILES
Stone Co
Pearl River Co
HANCOCK
HARRISON
JACKSON
MISSISSIPPI
ALABAMA
Gulfport
Biloxi
Pascagoula
Bay St. Louis
St. Bernard Parish
LOUISIANA

1 of 2

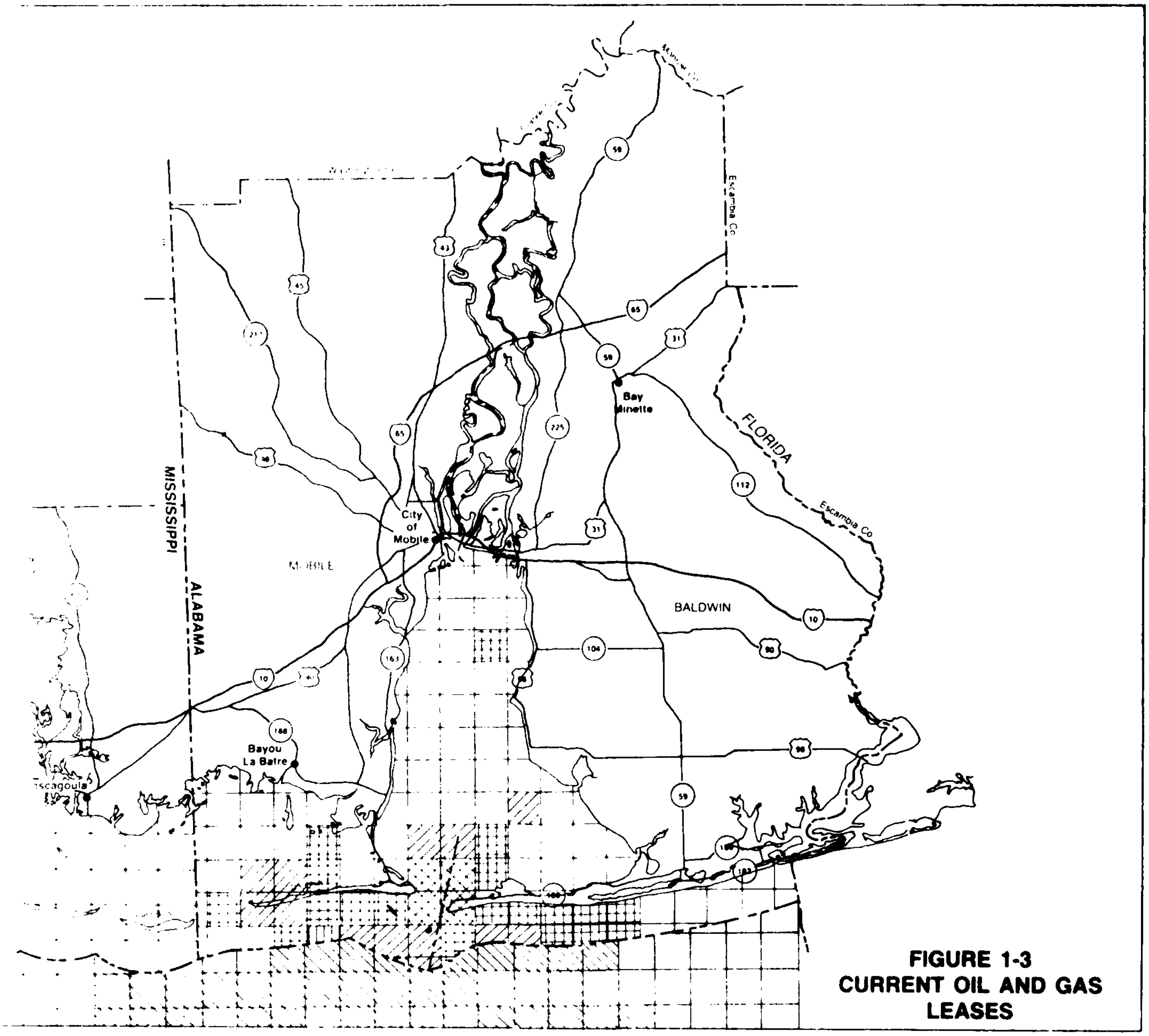

FIGURE 1-3 CURRENT OIL AND GAS LEASES

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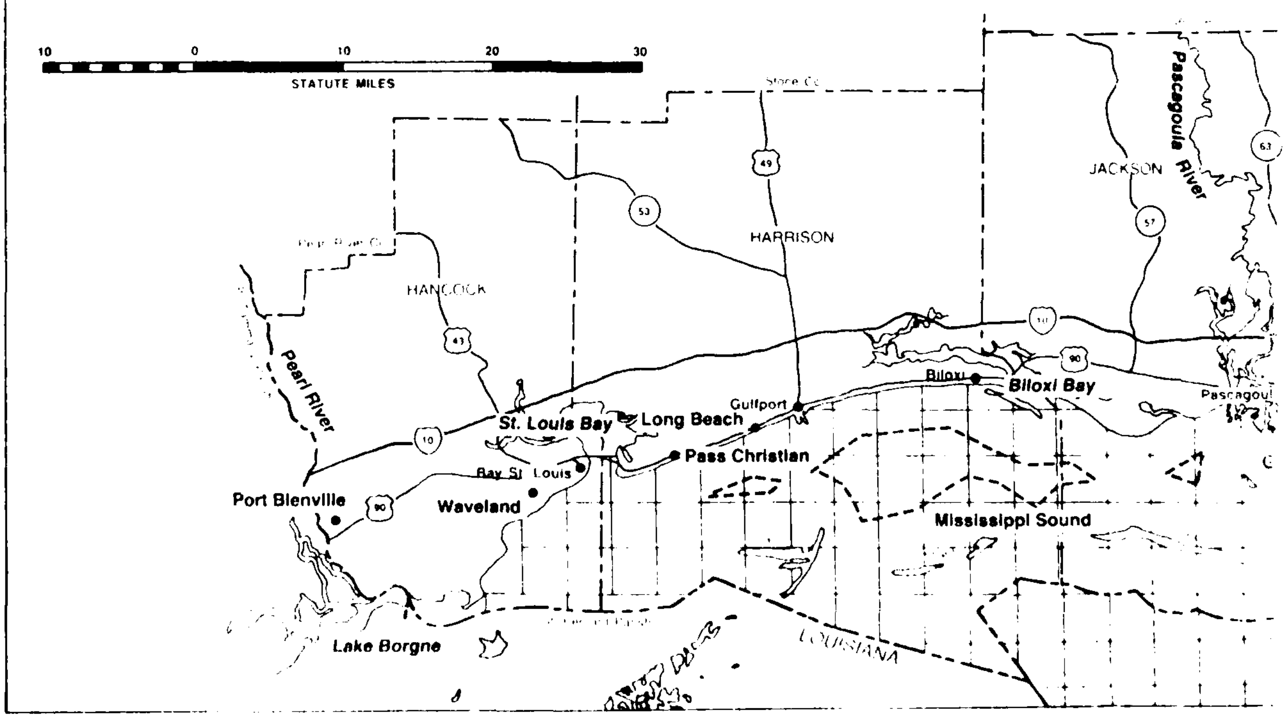
------ Approximate Boundary of Area Claimed by
Both the Federal Government and the States
(Mississippi Sound Enclaves)



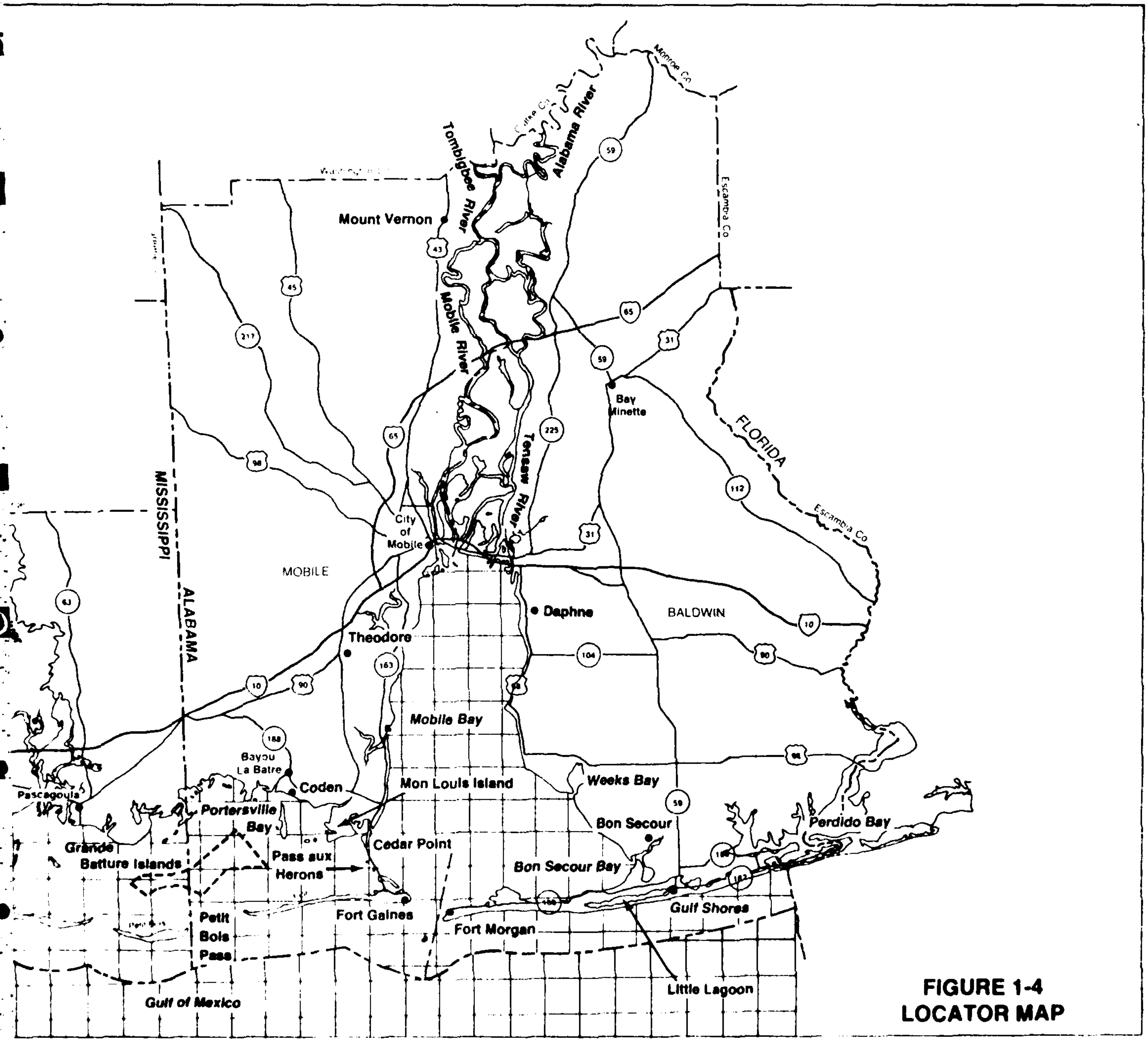


FIGURE 1-4
LOCATOR MAP

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CHAPTER 2

ALTERNATIVES

INTRODUCTION

2.1 Alternatives considered in this Generic Environmental Impact Statement include the no action alternative and those possibilities which have feasible methods, equipment and support systems that could be used for hydrocarbon exploration and production in the Mobile Delta, Mobile Bay, Mississippi Sound, state waters of the Gulf of Mexico and adjacent upland areas. These are considered for each region for unit actions of the geophysical exploration, drilling, production and abandonment phases of resource development. Additionally, the environmental effects of producing three alternative total quantities of hydrocarbons over the next 30 years in the study region have been investigated.

2.1a The no action alternative would be not to issue any additional permits for hydrocarbon exploration and production in the study region. Such a course of action would probably require legislative action at the national level since it is unlikely that sufficient grounds exist for the denial of all future permits regardless of circumstances. Because of this, the no action alternative is not considered further in this document.

Unit Action Alternatives

2.2 Unit actions based on various alternative methods, equipment and support requirements for the various activities within each hydrocarbon resource development phase have been identified. Four exploration and operating environments have been identified within the study region of southern Alabama and Mississippi:

- o The mostly forested and seasonally flooding Mobile Delta.
- o The shallow protected coastal waters of Mobile Bay and Mississippi Sound.
- o The nearshore Gulf of Mexico waters.
- o The adjacent upland areas.

The four environments serve as the basis for the unit action analysis in Chapters 4 through 7. The unit actions are analyzed for their generic environmental loadings and effects for the four operating environments within the study region. The unit actions considered are given in Table 2-1.

TABLE 2-1

UNIT ACTIONS CONSIDERED IN CHAPTERS 4 THROUGH 7

Mobile Delta	Mobile Bay And Mississippi Sound	State Waters Of The Gulf Of Mexico	Activit_es Occurring On Uplands
GEOPHYSICAL EXPLORATION PHASE			
Swamp buggies Surveys from Uplands	Seismic survey boats Marsh buggies in salt marshes	Seismic survey boats	Surveys from uplands
DRILLING PHASE			
Inland drilling barge Canal and slip River bank slip River channel location Fixed drilling platform Canal access Trestle road access River bank location Board road and ring levee Directional drilling from uplands	Inland drilling barge Jackup drilling rig Submersible drilling rig Fixed drilling platform Directional drilling from uplands	Jackup drilling rig Submersible drilling rig Fixed drilling platform Directional drilling from uplands	Upland well site
PRODUCTION PHASE			
Well completion Gathering system construction Normal operations of wells and pipelines Well workover Enhanced recovery	Well completion Platform installation Gathering system construction Normal operations of wells and pipelines Well workover Enhanced recovery	Well completion Production platform installation Gathering system construction Normal operations of wells and pipelines Well workover Enhanced recovery	Well completion Gathering system construction Treatment facility construction Normal operations of gathering system Normal operations of treatment facilities Well workover Enhanced recovery Transport of resource to intermediate market Services bases
ABANDONMENT PHASE			
Well site Pipelines	Well site Pipelines	Well site Pipelines	Upland well site Pipelines Treatment facilities Service bases

Regional Resource Development Scenarios

2.3 High, medium and low estimates have been made of the potential total recoverable hydrocarbon resource in the study region and assumptions made on the timing and intensity of the development of these resources over the next 30 years. The environmental effects associated with these three alternative scenarios are considered (Chapter 8). Details of scenario development are given in Appendix C.

Assumptions on Which All Analyses are Based

2.4 The following are assumptions on which all analyses have been based:

- No discharge will be allowed of drilling fluids, cuttings, formation waters, contaminated wastewaters or contaminated rainwater runoff into waters of the study region.

- Discharge will be allowed of uncontaminated rainwater, uncontaminated washwater, uncontaminated fire pump test water and non-contact cooling water to waters of the study region. However, a permit must be obtained from the state environmental agency prior to discharge.

- All canals and slips for use of an inland drilling barge will be restored to preproject contours upon abandonment.

- All dredged access channels to well sites will be backfilled upon abandonment.

- All pipeline trenches will be immediately backfilled to preproject contours

- All current local, state and federal regulations will be followed

- The number of surface structures in wetland and aquatic areas will be minimized, and some joint ventures will be used for pipelines.

The first 5 assumptions are current policy of state agencies and the Mobile District. Should these policies change in the future, the Generic Environmental Impact Statement may be supplemented and the findings and conclusions changed if necessary.

COMPARISON OF ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVES

2.5 The environmental loadings and generic environmental effects of unit actions in the Mobile Delta, Mobile Bay, Mississippi Sound, state waters of the Gulf of Mexico and upland areas adjacent to the study region are discussed in Chapters 4 through 7. The environmental effects of the three postulated resource development scenarios are discussed in Chapter 8. Comparisons of the effects associated with the alternatives considered are given in Tables 2-2 through 2-21. For the unit action analyses, separate comparison tables are given for geophysical exploration, drilling, production, abandonment and for spills, loss of well control and accidents. These 5 categories are considered for the Mobile Delta (Tables 2-2 through 2-6), Mobile Bay and Mississippi Sound (Tables 2-7 through 2-11), state waters of the Gulf of Mexico (Tables 2-12 through 2-16), and for associated activities occurring on upland areas adjacent to the study region (Tables 2-17 through 2-19). The cumulative environmental effects associated with the resource development scenarios are summarized in Tables 2-20 and 2-21.

TABLE 2-2

SUMMARY OF ENVIRONMMENTAL LOADINGS AND GENERIC EFFECTS OF THE USE OF SWAMP BUGGIES FOR GEOPHYSICAL EXPLORATION IN THE MOBILE DELTA

Parameter	Effect
Surface Water Resources	Suspension of sediments along pull boat and/or marsh buggy paths. Short-term (less than 30 days) creation of shallow water channel less than 1 meter deep. Relatively small amounts of refined fuels spilled as a result of boat/buggy traffic and exploration activities.
Wetland Ecosystems	1 acre disturbed per mile of survey (no vegetation clearing); swamp buggy would push through brush and maneuver around trees.
Drilling Fluids	Simple compounds used in small amounts (1/2 gallon per 100 gallons of water).
Groundwater	Possible contamination of shallow alluvial aquifer from shotholes.
Noise	Temporary increase in noise levels from vehicles. Impacts will be more intense than offshore areas due to the sensitive receptor nature of the Delta area. Noise levels similar to trucks are expected: 72-95 dBA at 50 ft.
Solid Waste	Shothole cuttings and drill muds disposed as backfill in shothole. Less than 10 cubic feet of cuttings per 100 feet of shothole. Drill mud volumes include the volume of the hole and a small circulation tank.
Air Emissions	Emission of pollutants from swamp buggies and/or small boats. Emissions (in tons/year/vehicle): TSP (.036), SO2 (.072), CO (.610), HC (.101) and NOX (.043).
Socioeconomic Characteristics	26 to 32 people needed for a survey; half the crew could be unskilled local hires. Skilled workers would commute on weekly basis and reside in nearby motel. Minor traffic increase at meeting point; extensive local purchases of gas, food and minor equipment repairs.

PARAMETERS	CANAL AND SLIP: SITE PREPARATION	CANAL AND SLIP: ROUTINE OPERATIONS	INLAND DRILLING BARGE – RIVER BANK LOCATION: SITE PREPARATION	RIVER BANK LOCATION: ROUTINE OPERATIONS	CHANNEL LOCATION: SITE PREPARATION	CHANNEL LOCATION: ROUTINE OPERATIONS	[illegible]
WETLAND ECOSYSTEM	[illegible] acres disturbed for large slip ([illegible] acres are dredged, [illegible] acres stockpiled), [illegible] acres disturbed per [illegible] feet of canal ([illegible] acres are dredged, [illegible] acres are dredged material stockpile).	Continued loss of wetland habitat.	[illegible] acres disturbed for large slip (2 acres are dredged, 2 acres stockpile).	Continued loss of wetland habitat.	Not affected.	Not affected.	[illegible]
AQUATIC ECOSYSTEM	About 1.3 acre of benthic habitat disturbed per 100 feet of channel dredging (leading to canal and slip). Increased turbidity could affect some organisms.	Propwash turbidity would affect organisms near mouth of canal; aquatic habitat created within canal and slip ([illegible] acres per 1000 feet of canal, 2 [illegible] acres per slip).	Effects same as for canal and slip.	Effects same as for canal and slip except aquatic habitat created would only be [illegible] acres.	Benthic habitat disturbed by dredged channel [illegible] about [illegible] acres [illegible] except [illegible] rapid.	Effects [illegible] canal and slip [illegible]	Effects same [illegible]
GROUNDWATER	Alteration of near surface hydrologic process from dredging.	Possible contamination of freshwater aquifer by exposure to drilling muds, formation water or hydrocarbons through improperly sealed wells, casing ruptures, or natural fractures in aquicludes.	Alteration of near surface hydrologic process from dredging.	Same as canal and slip.	No [illegible] impact.	Same as [illegible]	[illegible]
AIR EMISSIONS	Emissions from drilling equipment, miscellaneous construction and transportation activities. Includes rig activities, during completion and workover. Emissions (in tons per year): TSP ([illegible]3,484), SO_2 (26,168), CO ([illegible]163,49), [illegible] and NOX (390,[illegible]).		Emissions (in tons per year): TSP ([illegible]), [illegible]				[illegible]
NOISE	Increase in noise levels due to land clearing activities, dredging and transportation. Dozer: 80 dBA, 50 ft. Chain saw: 83 dBA (avg.), 50 ft. Tugboat: [illegible] dBA, [illegible] ft. Pile driving: [illegible] dBA, 50 ft.	Increase of noise levels from operation of drilling equipment and support activities. General drill rig: 85 dBA, [illegible] ft.	Same as canal and slip, with reduced dredging activities.	Same as canal and slip.	[illegible]	Same as [illegible]	Same [illegible]
SOLID WASTE	Construction debris disposed of at approved upland site. Biomass from land clearing disposed of on site. Dredge material from canal and slip stockpiled on site.	Production of spent drilling muds and cuttings per av. 21,000 ft. well: Liquids: 23,500-184,000 bbl. Cuttings: 6,000-9,000 bbl. Muds: [illegible]-17,000 bbl. Disposed of at approved site.	Dredge material from slip disposed of on site. Slip: [illegible],000 yd^3	Same as canal and slip.	[illegible]	Same as canal and slip [illegible]	[illegible]

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TABLE 2-[illegible]

SUMMARY OF ENVIRONMENTAL LOADINGS AND GENERIC EFFECTS OF THE DRILLING PHASE IN THE MOBILE DELTA

	CANAL ACCESS		[illegible] PLATFORM / TRESTLE ROAD A[illegible]		RIVER BANK LOCATION		BOARD ROAD AND RING LEVEE	
	SITE PREPARATION	ROUTINE OPERATION	SITE PREPARATION	ROUTINE OPERATION	SITE PREPARATION	ROUTINE OPERATION	SITE PREPARATION	ROUTINE OPERATION
	[illegible] acre disturbed for platform vegetation clearing only, [illegible] acres disturbed per 1000 feet of canal ([illegible] acres are dredged, 3 acres are dredged material stockpile), [illegible] acres disturbed for boat and large maneuver area (3/4 acre is dredged, [illegible] acres are dredged material stockpile).	Continued loss of wetland habitat in canal and maneuver areas. [illegible] reduction of habitat values under platform.	[illegible] acre disturbed for platform, [illegible] acre disturbed per 1000 feet of trestle road, vegetation clearing	Continued reduction of habitat values under trestle road and platform.	[illegible] acre disturbed for platform vegetation clearing.	Continued reduction of habitat values under platform	[illegible] acre disturbed per [illegible] feet of board road, additional 2 acres dredged per 1000 feet if board road is [illegible] fill from adjacent borrow ditches, 1/4 to [illegible] acre disturbed by boarded drilling pad, [illegible] acre disturbed by dredge and fill per 1000 feet of ring levee and ring levee borrow ditch.	Continued loss of wetland habitat under board road, boarded drilling pad, and ring levee, some alteration of unboarded habitat within ring levee
[illegible]use [illegible]oss [illegible]der	Effects same as for canal and slip preparation.	Effects similar to canal and slip operations except [illegible] [illegible] within [illegible] acres per [illegible] feet	Localized turbidity increase from pile driving and propwash.	Continued localized turbidity increase from propwash.	Localized turbidity increase from pile driving and propwash.	Continued localized turbidity increase from propwash.	Not applicable.	Not applicable.
	Same as canal and slip. Minimal impact to near surface aquifer from driving of support piles.	Same as canal and slip.	Impact to near surface aquifer from driving of piles.	Same as canal and slip.	Same as trestle road.	Same as Canal and Slip.	Same as Canal and slip.	Same as Canal and slip. Potential for contamination of shallow aquifer if unlined drilling fluid pits are utilized.
	Emissions from dredging and pile driving equipment and miscellaneous construction activities. Emissions (in tons per year): [illegible] SOx (26.[illegible]), [illegible] (162.[illegible]), THC ([illegible]) and NOX (390.[illegible]).	Same as canal and slip.	Emissions from pile driving equipment and miscellaneous construction activities. Emissions (in tons per year): TSP (13.435), SOx (26.[illegible]7), C[illegible] (162.61), THC ([illegible]), and NOx [illegible]	Same as canal and slip.	Same as Trestle Road.	Same as Canal and Slip.	Same as Canal and Slip. Emissions (in tons per year): TSP (13.523), S[illegible]2 (26.245), CO (164.22), THC (3.15), and NOX (39[illegible].[illegible]5)	Same as Canal and Slip.
	Same as canal and slip.	Same as canal and slip.	Increase in noise levels due to land clearing, pile driving and trestle construction and transportation activities. [illegible] 8[illegible] dBA, [illegible] ft. Pile driving: [illegible] dBA, [illegible] ft. [illegible] dBA, [illegible] ft.	Same as canal and slip	Same as trestle road, but without trestle construction.	Same as canal and slip.	Same as canal and slip, with board road construction and dredging for fill.	Same as canal and slip.
[illegible]ip	[illegible] from debris disposed of at approved upland site. Biomass from land clearing disposed of on site. Dredged material from canal and slip stockpiled [illegible]	Same as canal and slip.	Biomass from land clearing disposed of on site	Same as canal and slip.	Same as trestle road, with reduction in volume.	Same as canal and slip.	Solid waste limited to cleared vegetation and construction debris	Same as canal and slip.

2

Parameter	Inland Drilling Barge: Canal and Slip – Site Preparation	Canal and Slip – Routine Operations	River Bank Location – Site Preparation	River Bank Location – Routine Operations	River Barge – Site Preparation	River Barge – Routine Operations
WATER QUALITY	Turbidity plume from canal and slip dredging may extend 300-500 m down-stream of the canal, release of nutrients and oxygen demand from dredged sediments, dredging effects temporary and confined to the dredged area and adjacent river channel. Sediment resuspension and engine exhaust discharges from crew/supply boats and tugs. Resuspension of sediments during shell pad placement, pile driving, and barge placement. Creosote residue in canal water from timber pilings.	Sediment resuspension and engine exhaust discharges from crew/supply boats and tugs. Sediment from spoil piles carried by stormwater runoff. Low dissolved oxygen in waters six to eight feet deep can occur, thereby resulting in a different metabolically "slower" aquatic ecology than under aerobic conditions. Migratory animals can be eliminated if they become trapped in anoxic waters.	Turbidity plume from slip dredging may extend 300-500 m downstream of the slip; release of nutrients and oxygen demand from dredged sediments, dredging effects temporary and confined to the dredged area and adjacent river channel. Fewer sediments disturbed during dredging than Canal and Slip because smaller area affected. Sediment resuspension and engine exhaust discharges from crew/supply boats and tugs. Resuspension of sediments during shell pad placement, pile driving and barge placement.	Sediment resuspension and engine exhaust discharges from crew/supply boats and tugs. Sediment from spoil piles carried by stormwater runoff. Less likelihood of stagnant water than Canal and Slip because of wider mouth of slip adjacent to river. However, spill migration is more difficult to control.	Sediment disruption from driving timber piling and sheeting should be quickly dispersed by river currents. Creosote residues from timber piles dispersed by river. Some dredging may also be required, fewer sediments would be disturbed than for a river bank location.	Engine exhaust discharges from crew/supply boats, tugs, sediment resuspension than Canal and Slip because of deeper waters. Deposition and/or scouring of sediments around sheeting and piles by river.
[illegible]	Local disruption of river current around dredging barges and if canal extends far enough inland to take barge out of river, [illegible] current forms [illegible] in canal; circulation in canal [illegible] quite limited.	River current forms eddies in canal. Circulation in canal remains quite limited.	Local disruption of river current around dredging barges. River current forms eddies in slip.	River current forms eddies in slip.	Local disruption of river current around dredging barges.	Eddies from anchor piling, obstruction of river current by sheeting.
WASTEWATER DISPOSAL	Sanitary wastes from personnel, stormwater runoff from platforms, bilge and ballast water from boats and barges. No discharge; waste is stored on barges and hauled to treatment plants for disposal.	Sanitary wastes from personnel, stormwater runoff from platforms, bilge and ballast water from boats and barges, drilling mud liquids and formation water. No discharge; waste is stored on barges and hauled to treatment plants for disposal.	Same as Canal and Slip.	Same as Canal and Slip.	Same as Canal and Slip.	Same as Canal and Slip.

TABLE 2-3

...INGS AND GENERIC EFFECTS OF THE DRILLING PHASE IN THE MOBILE DELTA

			Fixed Drilling Platform						
	...nal Access		Trestle Road Access		River Bank Location		Board Road and Ring Levee		
...tine Operations	Site Preparation	Routine Operations	Site Preparation	Routine Operations	Site Preparation	Routine Operations	Site Preparation	Routine Operations	
...haust dis- ...rom crew ...ats, less ...resuspen- ...Canal and ...use of ...ers. ...or subur- ...iments ...eeting and river.	Same as Canal and [illegible] impacts slightly reduced [illegible]	Same as Canal and Slip.	Sediment runoff from site construction. Engine exhaust discharges from crew/supply boats and tugs, sediment disruption from driving mooring piles, creosote residues from timber piles dispersed by river.	Engine exhaust discharges from crew/supply boats and tugs.	Engine exhaust discharges from crew/supply boats and tugs. Sediment disruption from driving mooring piles. Creosote residues from timber piles dispersed by river.	Engine exhaust discharges from crew/supply boats and tugs.	Sediment runoff from site construction.	No discernible impact.	
...m around ... [illegible]	[illegible]	Same as Canal and Slip.	Local disruption of river current around moored barge.	Local disruption of river current around moored barge. Damming effect during high water.	Same as Inland Barge River Bank.	Same as Inland Barge River Bank.	No discernible impact.	Damming effect of spoil piles. Redirection of drainage patterns via borrow trenches.	
...anal and ...	Same as Canal and Slip.	Same as Canal and Slip.	Sanitary wastes from personnel, stormwater runoff from platforms, bilge and ballast water from boats and barges. No discharge, waste is stored in holding tanks or barge and hauled to treatment plants for disposal.	Sanitary wastes from personnel, stormwater runoff from platforms, bilge and ballast water from boats and barges, drilling mud liquids and formation water. No discharge, waste is stored in holding tanks or barge and hauled to treatment plants for disposal.	Same as Canal and Slip.	Same as Canal and Slip.	Same as Trestle Road.	Same as Trestle Road.	

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PARAMETER	INLAND DRILLING BARGE — CANAL AND SLIP — SITE PREPARATION	CANAL AND SLIP — ROUTINE OPERATION	RIVER BANK LOCATION — SITE PREPARATION	RIVER BANK LOCATION — ROUTINE OPERATION	[illegible] — SITE PREPARATION	[illegible] — ROUTINE OPERATION	[illegible] SITE [illegible] — SITE PREPARATION	[illegible]
SOCIO-ECONOMIC CHARACTERISTICS	Employment for 19 to 25 people to clear, dredge and construct the keyway. Most local labor, non-local labor would reside on dredge barge or in nearby motel. 2-3 weeks needed for site preparation, no appreciable effects on local economy or infrastructure.	Crew lives on board, personnel fluctuates between 20 and 36 people on rig at once. Little if any interaction with adjacent area. Local business involvement possible for some auxiliary activities. Staging areas leased at closest port.	Same as canal and slip alternative except only 1-2 weeks needed for clearing, dredging and keyway.	Same as canal and slip alternative.	Employment for [illegible] people. No clearing needed, less time than canal and slip alternative. All other aspects are the same	Same as canal and slip alternative.	Local businesses [illegible] participate. Employment for at least [illegible] to construct modules of a platform for a modular [illegible] rig, [illegible] clear the area, 6-8 [illegible] drive piles, several more to erect structure. Competitive bidding dictates the use of local firms versus out of state. Clearing and dredging same as canal and slip.	[illegible]
NAVIGATION	Increased waterway traffic (barge, crew boats); estimated maximum increase: 2 trips per day (1 dredge barge, 1 crew boat).	Increased waterway traffic (drill barge, mud and supply barges crew boats, small craft), estimated maximum increase: 5 trips per day (1 waste barge, 3 crew boats, 1 small craft).	Same as for canal and slip alternative.	Same as for canal and slip alternative.	Increased waterway traffic (dredge and pile driver barge, supply barge, crew boats); estimated maximum increase: 2 trips per day (1 dredge barge, 1 crew boat); possible interference with area navigation.	Same as for canal and slip alternative, possible interference with area navigation.	Same as for canal and slip alternative.	[illegible]

[1]No discharges are allowed from platforms or drilling barges with the exception of uncontaminated bilge and ballast water; discharges from marine vessels are allowed in conformance with U.S. Coast Guard regulations.

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TABLE 2-3 (Concluded)
SUMMARY OF ENVIRONMENTAL [illegible] AND
GENERIC EFFECTS OF THE DRILLING PHASE IN THE MOBILE DELTA

INLAND DRILLING BARGE								
RIVER BANK LOCATION				TRESTLE ROAD ACCESS		RIVER BANK LOCATION		
[illegible]EPARATION	ROUTINE OPERATION	SITE PREPARATION	ROUTINE OPERATION	SITE PREPARATION	ROUTINE OPERATION	SITE PREPARATION	ROUTINE OPERATION	[illegible]
[illegible]anal and slip [illegible]e except [illegible]eeks needed [illegible]ng, dredging	Same as canal and slip alternative.	Employment for 12-18 people. No clearing needed, less time than canal and slip alternative. All other aspects are the same	Same as canal and slip alternative.	Local businesses could participate. Employment for at least 30 to construct modules of a platform for a modular rig, 7 to clear the area, 4-8 to drive piles, several more to erect structure. Competitive bidding dictates the use of local firms versus out of state. Clearing and dredging same as canal and slip.	Employment for 8 to 10 people per 8 hour shift. Run like land operation. Most members would commute to the site daily, minor traffic increase at meeting point. Some retail purchases as commuters come and go.	20 to 25 jobs generated to build trestle road. Contract competitively bid. Non-skilled local labor possible for staging area jobs, rest are contractor's employees. Lumber for road could be locally purchased time consuming task, particularly clearing trees for pile driving.	Same as fixed platform with canal and [illegible] alternative.	[illegible] electing [illegible] as fixed [illegible] [illegible] tive, exc[illegible] is needed.
[illegible]r canal and [illegible]native.	Same as for canal and slip alternative.	Increased waterway traffic (dredge and pile driver barge, supply barge, crew boats); estimated maximum increase: 2 trips per day (1 dredge barge, 1 crew boat), possible interference with area navigation.	Same as for canal and slip alternative; possible interference with area navigation.	Same as for canal and slip alternative.	Same as for canal and slip alternative except that crew boat use would increase to 9 or 10 trips per day.	Similar to canal and slip alternative except that no barge-mounted dredge would be used, all traffic moored at bank of channel during site preparation.	Same as for canal and slip alternative except that crew boat use would increase to 9 to 10 trips per day, all traffic would use a barge moored in channel as a landing stage with possible interference with area navigation.	Similar t[illegible] slip alter[illegible] except tha[illegible] barge [illegible] would be [illegible] traffic [illegible] [illegible] channel [illegible] preparati[illegible]

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TABLE 2-3 (Concluded)
SUMMARY OF ENVIRONMENTAL LOADINGS AND
GENERIC EFFECTS OF THE DRILLING PHASE IN THE MOBILE DELTA

TRESTLE ROAD ACCESS		RIVER BANK LOCATION				BOARD ROAD AND RING LEVEE	
SITE PREPARATION	ROUTINE OPERATION	SITE PREPARATION	ROUTINE OPERATION	SITE PREPARATION	ROUTINE OPERATION	SITE PREPARATION	ROUTINE OPERATION
l businesses could icipate. Employ- for at least 30 onstruct modules platform for a lr rig. 7 to r the area, 4-8 to e piles, several to erect struc- . competitive ing dictates the of local firms as out of state. ring and dredging as canal and slip.	Employment for 8 to 10 people per 8 hour shift. Run like land operation. Most members would commute to the site daily, minor traffic increase at meeting point. Some retail purchases as commuters come and go.	20 to 25 jobs genera- ted to build trestle road. Contract com- petitively bid. Non- skilled local labor possible for staging area jobs, rest are contractor's employ- ees. Lumber for road could be locally pur- chased time consuming task, particularly clearing trees for pile driving.	Same as fixed platform with canal access alternative.	Constructing and erecting platform same as fixed platform with canal access alterna- tive, except no canal is needed.	Same as fixed platform with canal or trestle road access.	Employment for 25 to 30 people, half of whom could be local unskilled laborers even if non-local firm received contract. Area traffic would increase slightly during construction.	Same as fixed platform with canal access alternative.
as for canal and alternative.	Same as for canal and slip alternative except that crew boat use would increase to 9 or 10 trips per day.	Similar to canal and slip alternative except that no barge- mounted dredge would be used, all traffic moored at bank of channel during site preparation.	Same as for canal and slip alternative except that crew boat use would increase to 9 to 10 trips per day; all traffic would use a barge moored in channel as a landing stage with possible interference with area navigation.	Similar to canal and slip alternative except that no barge-mounted dredge would be used; all traffic moored at bank of channel during site preparation.	Same as platform and trestle road alterna- tive.	Not applicable.	Not applicable.

TABLE

SUMMARY OF ENVIRONMENTAL [illegible] AND HYDROCARBON [illegible]

PARAMETER	WELL COMPLETION	GATHERING SYSTEM CONSTRUCTION: WETLANDS	RIVER CROSSING: BORING	RIVER CROSSING: TRENCHING	NORMAL OPERATION OF WELLS AND PIPELINE GATHERING SYSTEMS	[illegible]
WATER QUALITY	Sediment resuspension and engine exhaust discharges from crew/supply boats and tugs. Resuspension of sediments from construction-related activities.	Sediment movement resulting in some leaching of nutrients, metals and humic materials.	Sediment from runoff. Possible drilling fluid contamination from exit hole and sediment from associated dike.	Sediment suspension during dredging of trench.	Sediment resuspension and engine exhaust discharges from crew/supply boats and tugs. Water quality in any canal or slip would be less favorable than in river channel.	[illegible]
HYDROLOGY	Local obstruction of current by barges/boats/tugs in river.	No discernible impact if pipeline trenches are plugged and filled following pipeline installation.	Local obstruction of current by exit hole dike.	Local obstruction of current by dredge barge and exposed pipeline trenches.	Local obstruction of current by rig/barges boats/tugs in river. Water circulation is less favorable in canals than in river channel.	[illegible]
WETLAND ECOSYSTEM	No additional effects would occur.	1 acre disturbed per 1000 feet of gathering line system (1/3 acre is dredged, 2/3 acre is work area).	1/4 to 1/2 acre disturbed for directional drilling rig (area cleared and board pad set down).	[illegible] to [illegible] acres disturbed by diked dredged material holding areas if hydraulic dredging is used.	Continued loss or reduction of habitat values.	[illegible]
AQUATIC ECOSYSTEM	Continuation of affects produced by drilling.	Some turbidity from runoff.	Not affected.	[illegible] acre of benthic habitat disturbed per [illegible] feet of pipeline; temporary loss of benthic communities and habitat area, localized turbidity.	Little effect on aquatic ecosystem, recolonization of trenched pipeline area and other dredged areas, new aquatic habitat established within any canal or slip, turbidity increase from service vessels.	[illegible]
WASTEWATER DISPOSAL	Sanitary wastes from personnel, stormwater runoff from platforms, bilge and ballast water from boats and barges. No discharge; waste is stored on barges and hauled to treatment plants for disposal.	Sanitary waste from personnel stored in holding tanks and hauled to treatment plant for disposal.	Same as wetlands gathering system construction.	Same as wetlands gathering system construction.	Formation waters separated and deep-well injected. Sanitary waste at processing plant treated and disposed of through septic tank system or municipal wastewater treatment system.	[illegible]
GROUNDWATER	Possible aquifer contamination from formation additives due to unintentional fracturing of and subsequent communication through aquicludes. Introduction of hydrocarbons and formation waters and additives by casing ruptures during fracturing efforts.	No discernible impact.	Possible contamination of shallow aquifer due to loss of drilling fluid.	No discernible impact.	Potential for contamination of shallow aquifer [illegible] pipeline failure and [illegible] aquifers due to well casing [illegible] rupture. Potential [illegible] contamination of aquifers [illegible] communication between [illegible] of failure [illegible] integrity during [illegible] of produced waters.	[illegible]
AIR EMISSIONS	Emissions from service vehicles and drill rig at rates reduced from exploratory drilling and generally with a smaller rig. Temporary use of compressors and pumps. Emissions in tons per year, not [illegible] [illegible]	Emissions from backhoe/dragline type equipment. Emissions (in tons per year): TSP [illegible], THC [illegible], SO₂ [illegible], and NOx [illegible].			Emissions from pumps, compressors and [illegible] emissions [illegible]	[illegible]

TABLE 2-4
SUMMARY OF ENVIRONMENTAL LOADING AND GENERIC ENVIRONMENTAL EFFECTS OF
HYDROCARBON PRODUCTION IN THE MOBILE DELTA

[illegible] RIVER CROSSING	TRENCHING	NORMAL OPERATION OF WELLS AND PIPELINE GATHERING SYSTEMS	WELL WORKOVER: INLAND BARGE RIG	WELL WORKOVER: FIXED PLATFORM	BOARD ROAD AND RING LEVEE	[illegible]
[illegible] runoff [illegible] fluid [illegible] sediment [illegible]	Sediment suspension during dredging of trench.	Sediment resuspension and engine exhaust discharges from crew/supply boats and tugs. Water quality in any canal or slip would be less favorable than in river channel.	Same as Well Completion.	Same as Well Completion.	Wetland covered by road, levee and facilities is not able to assimilate sediments, nutrients and other water constituents as well as undisturbed wetland.	Same as Well Completion.
[illegible]	[illegible] obstruction of current by dredge barge and exposed pipe line trenches.	Local obstruction of current by rig barges/ boats/tugs in river. Water circulation is less favorable in canals than in river channel.	Same as Normal Operation of Wells and Pipelines.	Same as Normal Operation of Wells and Pipelines.	Water moves through disturbed wetlands faster than through undisturbed wetland.	Same as Normal Operation of Wells and Pipelines.
[illegible]	[illegible] by fixed dredged material [illegible] areas [illegible] dredging [illegible] used.	Continued loss or reduction of habitat values.	No additional wetland area disturbed.	No additional wetland area disturbed.	No additional wetland area disturbed.	No additional wetland area disturbed.
[illegible]	[illegible] communities and habitat area, [illegible]	Little effect on aquatic ecosystem; recolonization of trenched pipeline area and other dredged areas, new aquatic habitat established within [illegible] and slip, turbidity increase from service vessels.	Turbidity increase for any site preparation and from vessel propwash.	Minor turbidity from service vessel propwash.	Not applicable.	Only affected if pipeline installed; effects similar to gathering line installation.
[illegible] system [illegible]	Same as well [illegible] gathering system [illegible]	Formation waters separated and deep well injected. Sanitary waste at processing plant treated and disposed of through septic tank system or municipal wastewater treatment system.	Same as Well Completion.	Same as Well Completion.	Same as Well Completion.	Same as Well Completion.
Contamination [illegible] aquifer due [illegible] drilling	No discernible impact.	Potential for contamination of shallow aquifer due to pipeline failure and deeper aquifers due to well casing rupture. Potential for contamination of aquifers by communication between strata or failure of injection well integrity during injection of produced waters.	Same as exploratory drilling, with generally reduced activities and the addition of solvents and other formation additivies.	Same as inland barge	Same as inland barge	Possible contamination from drilling new well (i.e., inland barge). Otherwise, no discernible impact.
[illegible] equipment. [illegible] (.014), SO2 (.039), CO (.336),		Emissions from pumps, compressors and flaring. Emissions (in tons per year): TSP (.146), [illegible] (.280), CO (2.[illegible]), [illegible], and NOX (.20).	Emissions from service vehicles and a generally smaller workover rig as compared to exploratory drilling, operating for only 3 to 8 months. Emissions (in tons per year, not including rig): TSP (.006), SO2 (.012), CO (.101), THC (.107), and NOX (.008).			Emissions from pumps and [illegible]ties, assuming no new [illegible] Emissions (in tons per [illegible] and NOX (.38).

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TABLE 2-4
LOADING AND GENERIC ENVIRONMENTAL EFFECTS OF
PRODUCTION IN THE MOBILE DELTA

...LLS ...G	WELL WORKOVER: INLAND BARGE RIG	WELL WORKOVER: FIXED PLATFORM	BOARD ROAD AND RING LEVEE	ENHANCED RECOVERY: GAS LIFT	ENHANCED RECOVERY: PUMPING	ENHANCED RECOVERY: MATERIAL INJECTION
...3- ...ply ...or ...er	*Same as Well Completion.*	Same as Well Completion.	Wetland covered by road, levee and facilities is not able to assimilate sediments, nutrients and other water constituents as well as undisturbed wetland.	Same as Well Completion.	Same as Well Completion.	Same as Well Completion.
.../ ...less ...han	Same as Normal Operation of Wells and Pipelines.	Same as Normal Operation of Wells and Pipelines.	Water moves through disturbed wetlands faster than through undisturbed wetland.	Same as Normal Operation of Wells and Pipelines.	Same as Normal Operation of Wells and Pipelines.	Same as Normal Operation of Wells and Pipelines.
	No additional wetland area disturbed.	No additional wetland area disturbed.	No additional wetland area disturbed.	No additional wetland area disturbed.	No additional wetland area disburbed.	No additional wetland area disturbed if existing well converted to material injection; for any new well, the amount of wetland altered would be the same as described for the various drilling alternatives in Table 4-2.
	Turbidity increase for any site preparation and from vessel propwash.	Minor turbidity from service vessel propwash.	Not applicable.	Only affected if pipeline installed; effects similar to gathering line installation.	Some turbidity if wellhead platform is installed.	For new wells effects same as for original drilling and pipeline crossing; for use of existing wells turbidity increase from service vessel propwash.
...a- ...r	*Same as Well Completion.*	*Same as Well Completion.*	Same as Well Completion.	Same as Well Completion.	Same as Well Completion.	Same as Well Completion.
...ination ...ue to ...deeper ...casing ...for ...ifers by ...n strata ...ion well ...jection	Same as exploratory drilling, with generally reduced activities and the addition of solvents and other formation additivies.	Same as inland barge	Same as inland barge	Possible contamination from drilling new well (i.e., inland barge). Otherwise, no discernible impact.	Not applicable.	Contamination same as inland barge. Over pressure casing rupture may cause loss of solvents enhancement or formation fluids to a freshwater aquifer.
...s, ...ring. ...per year) ...30), ...80), and	Emissions from service vehicles and a generally smaller workover rig as compared to exploratory drilling, operating for only 3 to 8 months. Emissions (in tons per year, not including rig): TSP (.006), SO2 (.012), CO (.101), THC (.107), and NOX (.008).			Emissions from pumps and compressors and associated transportation activities, assuming no new wells are drilled. Emissions (in tons per year): TSP (.026), SO2 (.052), CO (.458), THC (.075), and NOX (.038).		

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PARAMETER	WELL COMPLETION	GATHERING SYSTEM CONSTRUCTION: WETLANDS	GATHERING SYSTEM CONSTRUCTION: RIVER CROSSING: BORING	GATHERING SYSTEM CONSTRUCTION: RIVER CROSSING: TRENCHING	NORMAL OPERATION AND PIPELINE G[illegible] SYSTE[illegible]
NOISE	Increase in noise levels associated with operation of generally smaller drilling rig. Also noise from pumps, compressors, lifts and boats. Pumps: 76 dBA, 50 ft. Air Compressor: 92-100 dBA, at source.	Increased noise levels from land clearing (forested wetlands), dragline/backhoe (wetlands). Land trenching: 88 dBA (average).	Same as wetland/water, substituting a boring rig for trenching equipment.	Same as wetland/water.	Intermittent no[illegible] ted with inspec[illegible] maintenance. Motorboat: 80 d[illegible] Gas venting (bl[illegible] 80 dBA (with [illegible] 140 dBA (witho[illegible]
SOLID WASTE	Production of small amounts of cuttings and muds, mostly formation fluids with completion additives. Disposed of at an approved site.	No discernible impact.	Cuttings and inert muds generated equal to the volume of the bore. Disposed of at an approved site.	No discernible impact.	No discernible
SOCIOECONOMIC CHARACTERISTICS	One of the busiest phases; traffic and personnel increase. 8-15 additional people on board at once. More barges and tugs, probably from local business. A crew of about 10 needed to install production platform and minimum equipment.	30 to 100 workers needed to survey, clear, lay and secure the pipe. 60% could be local labor. Monetary influx to acquire rights-of-way. Temporary effects on wages, taxes, and local purchases. Traffic increases at staging area from workers and material deliveries.	Employment for 30 people. Specialized crew used, stays in local motel for the 4-6 weeks of the project. Little if any local employment. Minor retail purchases made by employees, short term traffic increase at landing, crew boats could be locally contracted.	Personnel and effects same as in gathering system construction in wetlands.	State begins se[illegible] tax and royalt[illegible] a $30/bbl [illegible] earn $3 severa[illegible] royalty. A [illegible] $3.45 could [illegible] ance and M&E [illegible] Ten people need[illegible] well and care f[illegible] equipment; it's employment. Pi[illegible] mostly automat[illegible]
NAVIGATION	Increased waterway traffic (crew boat, supply barges); estimated maximum increase: 7 trips per day (1 barge, 6 crew boats), 12-14 trips per day for a 6 crew boats), 12-14 trips per day for a platform rig (1 barge, 11-13 crew boats).	Not applicable.	Not applicable.	For hydraulic dredging, up to half of waterway blocked by a floating discharge pipe connecting the dredge with either of two upland dredged material stockpile areas; on narrow waterways with one side only stockpile area, the entire channel would be blocked. For draglinedredging, navigation would be affected only in the immediate vicinity of the dredge.	Minimal increas[illegible] waterway traffi[illegible] trips by smal[illegible] crew boat.

[1] No discharges are allowed from platforms or drilling barges with the exception of uncontaminated bilge and ballast water; discharges from marine vessels are allowed in conformance with U.S. Coast Guard regulations.

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TABLE 2-4 (Concluded)
SUMMARY OF ENVIRONMENTAL LOADING AND GENERIC ENVIRONMENTAL EFFECTS OF HYDROCARBON PRODUCTION IN THE MOBILE DELTA

...HERING SYSTEM CONSTRUCTION	RIVER CROSSING: BORING	RIVER CROSSING: TRENCHING	NORMAL OPERATION OF WELLS AND PIPELINE GATHERING SYSTEMS	INLAND BARGE RIG	WELL WORKOVER: FIXED PLATFORM	WELL WORKOVER: BOARD ROAD AND RING LEVEE	GAS ...
...evels ...g (for- ...drag- ...lands). ...8 dBA	Same as wetland/water, substituting a boring rig for trenching equipment.	Same as wetland/water.	Intermittent noise associated with inspection and maintenance. Motorboat: 80 dBA, 50 ft. Gas venting (blowdown): 80 dBA (with silencer), 140 dBA (without).	Similar to increased noise from well completion, generally of a shorter duration (3 to 8 weeks).	Same as inland barge rig.	Same as inland barge rig.	Incre... due ... comp... and s...
...pact.	Cuttings and inert muds generated equal to the volume of the bore. Disposed of at an approved site.	No discernible impact.	No discernible impact.	Production of drilling fluids similar to exploratory drilling, muds, cement, cuttings, and fracturing chemicals. Drilling fluids: 2,000 bbl/well. Disposed at approved site.	Same as inland barge rig.	Same as inland barge rig.	No di... assur... are d...
...ture ...ld ...one- ...uire ...mpo- ...ges, ...ur- ...ng ...and ...s.	Employment for 30 people. Specialized crew used, stays in local motel for the 4-6 weeks of the project. Little if any local employment. Minor retail purchases made by employees, short term traffic increase at landing, crew boats could be locally contracted.	Personnel and effects same as in gathering system construction in wetlands.	State begins severance tax and royalty collection a $30/bbl of oil could earn $3 severance and $750 royalty. A mmBtu of gas at $3.45 could earn 34¢ severance and 86¢ in royalties. Ten people needed to monitor well and care for platform equipment; it's long term employment. Pipeline is mostly automated.	Same as initial off-shore drilling operation.	Same as initial drilling with a lightweight modular rig.	Same as initial drilling with a lightweight modular rig.	If ... need- and the ... pipe...
	Not applicable.	For hydraulic dredging, up to half of waterway blocked by a floating discharge pipe connecting the dredge with either of two upland dredged material stockpile areas; on narrow waterways with one side only stockpile area, the entire channel would be blocked. For draglinedredging, navigation would be affected only in the immediate vicinity of the dredge.	Minimal increase in waterway traffic: 1-2 trips by small craft or crew boat.	Increased waterway traffic (barge-mounted workover rig, barge, crew boat); estimated maximum increase: 2-4 trips per day (1 barge, 1-3 crew boats).	Same as for barge workover operations except crew boat use could range from 6 to 9 trips per day.	Not applicable	Not a...

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TABLE 2-4 (Concluded)
...MENTAL LOADING AND GENERIC ENVIRONMENTAL EFFECTS OF
...OCARBON PRODUCTION IN THE MOBILE DELTA

...OF WELLS ...HERING	WELL WORKOVER			ENHANCED RECOVERY		
	INLAND BARGE RIG	FIXED PLATFORM	BOARD ROAD AND RING LEVEE	GAS LIFT	PUMPING	MATERIAL INJECTION
...e associa- ...on and ..., 50 ft. ...down): ...encer), ...).	Similar to increased noise from well completion, generally of a shorter duration (3 to 8 weeks).	Same as inland barge rig.	Same as inland barge rig.	Increased noise levels due to the use of compressors and pumps and service vehicles.	Pump: 76 dBA, 50 ft. Air compressor: 92-100 dBA, at source. Tug: 54 dBA (L_{50}), 100 ft. No pump/compressor noise if pressurized gas is recycled (via pipes) from treatment plant.	
...pact.	Production of drilling fluids similar to exploratory drilling, muds, cement, cuttings, and fracturing chemicals. Drilling fluids: 2,000 bbl/well. Disposed at approved site.	Same as inland barge rig.	Same as inland barge rig.	No discernible impact, assuming no new wells are drilled.	No discernible impact.	No discernible impact.
...tance ...ollection ...could ... and $750 ..., of gas at ...34¢ sever- ...oyalties. ... to monitor ... platform ...ng term ...line is	Same as initial off-shore drilling operation.	Same as initial drilling with a lightweight modular rig.	Same as initial drilling with a lightweight modular rig.	If new pipeline was needed, requirements and effect would be the same as initial pipelaying.	Same as equipment installation on production platforms.	If new wells, pipelines or platform equipment are needed effects would be the same as initial activities.
...in ... 1-2 ...aft or	Increased waterway traffic (barge-mounted workover rig, barge, crew boat); estimated maximum increase: 2-4 trips per day (1 barge, 1-3 crew boats).	Same as for barge workover operations except crew boat use could range from 6 to 9 trips per day.	Not applicable	Not applicable.	Not applicable.	Similar to initial drilling operation.

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TABLE 2-5

EFFECTS OF WELL FIELD ABANDONMENT IN THE MOBILE DELTA

Parameter	Well Sites	Pipelines
Water Quality	Sediment disruption from removing facilities. Turbidity plume in canal and river as dredged area is returned to its original contours. Concomitant release of oxygen-demanding organics and any soluble nutrients. Sediment resuspension and engine exhaust discharges from supply/crew boats.	Sediment disruption from removing above ground structures. Pipelines remain in ground.
Hydrology	Only local obstructions of natural natural currents from barges/boats moored in the river assuming pre-development site conditions can be achieved.	Not affected except slowly as natural wetland vegetation fills pipeline right-of-way.
Wetland Ecosystems	Canals and slips restored by filling with stockpiled dredged material and extra fill as needed; recovery under platform and trestle.	Vegetation succession would result in regrowth similar to adjacent areas.
Aquatic Ecosystems	Refilling canals and slips would bury aquatic ecosystem that had developed. Ending of vessel traffic would eliminate turbidity from propwash.	Not affected if pipelines abandoned in place.
Wastewater Disposal	Sanitary wastes from personnel stored in tanks/barge and hauled to treatment plant for processing and disposal.[1]	Flushing fluids collected at processing plant.
Groundwater	Possibility of improperly plugged well providing conduit for formation waters to flow to surface and impact shallow aquifers through infiltration or loss directly from abandoned well to freshwater aquifer.	No discernible impact.
Noise	Noise level increase due to general construction activities: Welding: 77 dBA (average) Backhoe: 85 dBA, 50 ft.	Same as well sites but only applicable to above ground structures. Pipes remain in ground.
Solid Waste	Generation of general construction waste. Impact minimal. Disposed of at an approved site.	Same as well site for above ground structures. Pipes remain in ground.
Air Emissions	Emissions from service vehicles. Emissions (in tons per year): TSP (.003), $SO2$ (.006), CO (.05), HC (.008) and NOX (.004).	
Socioeconomic Characteristics	Employment to remove platform and equipment. 4 to 10 to remove mooring structure and 8 to 10 needed to refill canal and slip. Local nursery could revegetate and monitor succession. Severance tax and royalty collection would terminate.	At most a small crew would flush and clean the pipeline. No significant effects would be likely.
Navigation	Increased waterway traffic (barge, crew boat); estimated maximum increase: 3-5 trips per day (1-2 barges, 2-3 crew boats); removal of production platform and mooring piles from channel would remove potential hazard to navigation.	Not applicable.

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[1]No discharges are allowed from platforms or drilling barges with the exception of uncontaminated bilge and ballast water; discharges from marine vessels are allowed in conformance with U.S. Coast Guard regulations.

TABLE 2-6

SUMMARY OF THE EFFECTS OF SPILLS OF MATERIAL OR RELEASE TO THE ATMOSPHERE OF NATURAL GAS CONTAINING H_2S IN THE MOBILE DELTA

ACCIDENT	EFFECT
	-DRILLING-
Spills Crude Oil	Direct toxic effect on organisms downstream if spill is large and uncontained. In southern Delta, waterfowl could be greatly affected if present in large numbers. Aromatic fraction would be diluted and evaporated. Much of saturated fraction carried to sediments. Persistence of oil in sediments for many years is possible, especially in floodplain area. Sublethal effects on productivity and sediment organisms could last several years where oil concentrations were great enough.
Fuel Oil	75,000 to 100,000 gallons in drilling barge storage tanks. 40,000 gallons in fuel transport barges. Effect of spill would be similar to crude oil spill.
Chemicals	Volumes spilled would be small. Effects, if any, would be localized because of dilution.
Drilling Muds	Most material would sink to bottom at site of spill. Turbid plume of small quantity of fine material would extend away from site. Effect would be localized. Material slowly diluted in channel by bedload transport. Spill in canal would be buried when canal restored. Some localized contamination of groundwater could occur.
Natural Gas Containing H_2S	Most gas would bubble to surface. Hydrogen sulfide dissolved would be oxidized and diluted in water column. Could be some effect in confined canal.
Atmospheric Release of Gas Containing H_2S	H_2S is heavier than air, but normally it is released under pressure and mixed with methane which is lighter than air. Initially, there would be some vertical distribution of the H_2S because of mixing with methane. Most regulatory agencies require that the applicant show a "fail-safe" or emergency planning analysis which would preclude major hazards to the public or flora and fauna. Generally, the belief is that concentrations greater than 10.0 ppm over an 8 hour day should be avoided. There are basically two types of accidents; pipeline rupture and well *blowouts*. Studies of various site, pressure and duration pipeline ruptures indicate up to 11 million cubic feet of H_2S gas may be released. Under these conditions, concentrations between 117 and 154 ppm have been calculated at distances equal to or less than 200 meters from the break. Well blowouts are more likely to occur where they affect oil company personnel. In general, procedures for minimizing the likelihood of such an event have been well documented and safety training is an integral part of oil rig personnel. Again, here concentrations usually are less than 100 ppm relatively close to the source. The hazard associated with either of these two types of accidents is dependent upon the distance between the location of the accident and the prevailing wind at the time of the accident-regardless of the geographical area.
Socioeconomic Characteristics	An accident could affect use of waterbody by hunters, boaters and fishermen. \$4.9 million annually spent in Delta area for tackle, food, lodging and biat. Waterfowl hunting could be effected depending on time of the year of the accident.
	PRODUCTION
Spills Well Servicing	Solvents and materials used in small volumes. Effects, if any, would be very localized.
Pipeline Rupture	Crude oil released in wetland at low water would kill vegetation in area affected by pooled oil. Oil released to water would have effects described for spill during drilling.
Well Workover	Activity is like drilling phase. Spills would be similar to those described for drilling.
Enhanced Recovery	Materials such as water, steam and CO_2 would have negligible effects if released. Other chemicals that might be used could have some effect depending on circumstance of spill.
Pipeline Rupture Releasing Natural Gas Containing H_2S	Same as drilling.
Socioeconomic Characteristics	Same as drilling.

TABLE 2-7

SUMMARY OF ENVIRONMENTAL LOADINGS AND GENERIC EFFECTS OF GEOPHYSICAL SURVEYS IN MOBILE BAY AND MISSISSIPI SOUND

Parameter	Seismic Survey Boats in Bay and Sound	Marsh Buggies in Salt Marsh
Surface Water Resources	Very short-term (less than 1 hour) turbulence due to boat wake and possibly due to explosion activity. Relatively small amounts of refined fuels and oils spilled as a result of boat traffic and exploration activities.	Suspension of sediments along marsh buggy path. Short-term (less than 30 days) creation of shallow water channel less than 1 meter deep. Relatively small amounts of refined fuels spilled as a result of marsh buggy traffic and exploration activities.
Aquatic Ecosystems	Potential minor effect from survey boat and air gun operations.	Not applicable.
Wetland Ecosystems	Not applicable.	1 acre disturbed per mile of survey line. Vegetation crushed. Excessive rutting could alter water flow patterns. Soil compaction could hinder vegetation recovery.
Drilling Fluids	Not applicable.	Simple compounds used in small amounts (1/2 gallon per 100 gallons of water).
Wastewater Disposal	Sanitary wastes (10 to 40 gallons per person per day) and other boat or buggy wastes would also be discharged in the study area in conformance with U.S. Coast Guard regulations.	
Groundwater	Not applicable.	Possible contamination of shallow aquifer from shot holes.
Air Emissions	Emissions from survey vehicles. Emissions (in tons per year): TSP (0.7), SO2 (.14) CO (1.21), HC (.20) and NOX (.10).	
Noise	No discernible impact. Noise levels similar to ambient marine traffic.	Temporary increase in noise levels from survey vehicles. Noise will be more noticeable in sensitive receptor shore-line areas. Noise levels similar to trucks are expected: 72-95 dBA, 50 ft.
Solid Waste	Shothole cuttings and mud disposed as backfill in shothole. Less than 10 cubic feet of cuttings per hole. Drill mud volumes include the volume of the hole plus a small circulation tank.	Shothole cuttings and drill muds disposed as backfill in shothole. Less than 10 cubic feet of cuttings per 100 feet of shothole. Drill muds volumes include the volume of the hole of a small circulation tank.
Socioeconomic Characteristics	15-16 member crew on 2 boats for a 14-day tour, 2-3 could be local hires. Intermittent interaction with shore to purchase supplies, fuel or dock between contracts.	Employment for 5-7 technical surveyors, 9 operators of 3 shot hole rigs, and several unskilled laborers. Laborers could reside in the adjacent area. Purchases of gas, food and minor repairs could be made in adjoining communities.
Navigation	Potential impact from survey boat towing mile-long survey cable.	Not applicable.

PARAMETER	INLAND DRILLING BARGE			
	MOBILE BAY AND MISSISSIPPI SOUND		SALT MARSH	
	SITE PREPARATION	ROUTINE OPERATION	SITE PREPARATION	ROUTINE OPERATION
WATER QUALITY	Circulation, salinity and sediment disruption from pile and sheet driving and access dredging. Possible release of nutrients and oxygen-demanding substances from dredged sediments. Resuspension of sediments during shell pad placement. Creosote residue from timber piles. Sediment resuspension and engine exhaust discharges from crew/supply boats and tugs.	Sediment resuspension and engine exhaust discharges from crew/supply boats and tugs.	Same as Bay/Sound.	Same as Bay Sound.
HYDROLOGY	Small amounts of local disturbance of currents around barges, boats and dredged areas.	Local disturbance of currents around barges and dredged areas.	Local disturbance of currents around access dredging during high tide submergence of salt marsh. Increase in wa[illegible] velocities due to canal-open water connection	Local disturbance of currents during high tide submergence of salt marsh. Increase in water velocities due to canal-open water connection.
WETLAND ECOSYSTEM	Not applicable.	Not applicable.	Same as for canal and slip in Delta: 5 acres disturbed for barge slip, 5-6 acres disturbed per 1000 feet of canal.	Continued loss of w[illegible] habitat.
AQUATIC ECOSYSTEM	Loss of 0.3 to 0.7 acres of benthic habitat (buried under shell pad); fouling community habitat created on sheet steel (0.5 acres); turbidity generated in placement of shell pad and by vessel propwash.	Continued loss of benthic habitat for drilling period; localized increase in turbidity.	Benthic habitat lost in dredged channel for salt marsh access: 3 acres lost per 1000 feet of channel (1 1/2 acres for channel, 1 1/2 acres for dredged material storage). Turbidity from channel dredging could affect oyster populations.	Dredged channel and acrea[illegible] of dredged ma[illegible] would recolonize bu[illegible] benthic community [illegible] be different. Oyste[illegible] reefs under sedimen[illegible] layer would not be reestablished.
WASTE WATER DISPOSAL	Sanitary wastes from personnel, stormwater runoff from platforms, bilge and ballast water from boats and barges. No discharge;(1) waste is stored on barges and hauled to treatment plants for disposal.	Sanitary wastes from personnel, stormwater runoff from platforms, bilge and ballast water from boats and barges, drilling mud liquids and formation water. No discharge;(1) waste is stored on barges and hauled to treatment plants for disposal.	Same as Bay/Sound.	Same as Bay/Sound.
GROUNDWATER	Not applicable.	Possible contamination of freshwater aquifer by exposure to drilling muds, formation waters or hydrocarbons through improperly sealed wells, casing ruptures, or natural fractures in aquicludes.	Not applicable.	Same as Bay Sound.
AIR EMISSIONS	Emissions from dredge, pile driver, drill rig, and support vehicles. Includes rig activity [illegible] completion and workover. Emissions (in tons per year): [illegible], SO_2 (26.[illegible]), [illegible], [illegible] (3.0), and NOX (390.1).			
NOISE	Noise levels increase due to pile driver and increased marine traffic. Tugboat: 54-62 dBA (L_{50}), 100 ft. Pile driving: 101 dBA, 50 ft.	Increase in noise levels from operation of drilling equipment and support activities. Generic drill rig: 85 dBA, 100 ft.	Same as Bay/Sound but with dredging noise [illegible].	Same as Bay/Sound. [illegible] levels [illegible] near sensitive [illegible] shorelines.

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TABLE 2-8
SUMMARY OF ENVIRONMENTAL LOADING AND GENERIC EFFECTS OF
DRILLING MOBILE BAY AND MISSISSIPPI SOUND

	INLAND DRILLING BARGE			JACKUP AND SUBMERSIBLE DRILLING RIG		
	D MISSISSIPPI SOUND	SALT MARSH				
	ROUTINE OPERATION	SITE PREPARATION	ROUTINE OPERATION	SITE PREPARATION	ROUTINE OPERATION	CONSTRUCTION
y and from ng	Sediment resuspension and engine exhaust discharges from crew/supply boats and tugs.	Same as Bay/Sound.	Same as Bay/Sound.	Sediment disruption by legs of jack-up rig, pile driving. Creosote residue from timber piles. Engine exhaust discharges from crew/supply boats and and tugs.	Same as Bay/Sound.	Sediment disrupti during constructio platform. Creoso residue from timbe Engine exhaust di from crew/supply tugs.
ts. ad e ts						
al nts	Local disturbance of currents around barges and dredged areas.	Local disturbance of currents around access dredging during high tide submergence of salt marsh. Increase in water velocities due to canal-open water connection	Local disturbance of currents during high tide submergence of salt marsh. Increase in water velocities due to canal-open water connection.	Local disturbance of currents around barges and boats. Increase in water velocities due to canal-open water connection.	Local distruance of currents around rig and service craft.	Same as jack-up.
	Not applicable.	Same as for canal and slip in Delta: 5 acres disturbed for barge slip, 5-6 acres disturbed per 1000 feet of canal.	Continued loss of wetland habitat.	Not applicable.	Not applicable	Not applicable.
res ouried aling eated nt	Continued loss of benthic habitat for drilling period; localized increase in turbidity.	Benthic habitat lost in dredged channel for salt marsh access: 3 acres lost per 1000 feet of channel (1 1/2 acres for channel, 1 1/2 acres for dredged material storage). Turbidity from channel dredging could affect oyster populations.	Dredged channel and acrea of dredged material would recolonize but benthic community could be different. Oyster reefs under sediment layer would not be reestablished.	Loss of 0.2 acres of habitat under jackup legs, 0.4 to 0.7 acres under hull of submersible; fouling community habitat created on underwater portions of both rigs; localized turbidity during rig placement.	Continued loss of benthic habitat.	Minimal additional area disturbed by legs; extremely lo short-term turbidi increase during pl emplacement; fouli community habitat on legs of platfor
per- noff- a s	Sanitary wastes from personnel, stormwater runoff from platforms, bilge and ballast water from boats and barges, drilling mud liquids and formation water. No discharge;(1) waste is stored on barges and hauled to treatment plants for disposal.	Same as Bay/Sound.	Same as Bay/Sound.	Same as Bay/Sound.	Same as Bay/Sound.	Same as Bay/Sound.
	Possible contamination of freshwater aquifer by exposure to drilling muds, formation waters or hydrocarbons through improperly sealed wells, casing ruptures, or natural fractures in aquicludes.	Not applicable.	Same as Bay/Sound.	Not applicable.	Same as Bay/Sound.	No discernible im
r.	pile driver, drill rig, and support vehicles. Includes rig activity during r. Emissions (in tons per year): TSP (13.47), SO2 (26.14), CO (163.21), HC			Emissions from drill rig and support vehicles. Includes rig activit Emissions (in tons per year): TSP (13.92), SO2 (26.105), CO (162.41		
ic.	Increase in noise levels from operation of drilling equipment and support activities. Generic drill rig: 85 dBA, 100 ft.	Same as Bay/Sound but with dredging noise added.	Same as Bay/Sound. Noise levels more noticeable near sensitive receptor shorelines.	Noise level increase due to marine traffic and possible transport by helicopter. Large tug, loaded: 54-55 dBA (L_{50}), 100 ft. Tug alone: 47 dBA (L_{50}), 100 ft. Motorboat: 80 dBA (avg.) 30 ft. Helicopter: 70-90 dBA, 1000 ft.	Same as Bay/Sound.	Same as jack-up.

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TABLE 2-8
ENVIRONMENTAL LOADING AND GENERIC EFFECTS OF
.LING MOBILE BAY AND MISSISSIPPI SOUND

	JACKUP AND SUBMERSIBLE DRILLING RIG		FIXED PLATFORM	
	SITE PREPARATION	ROUTINE OPERATION	CONSTRUCTION	OPERATION
	Sediment disruption by legs of jack-up rig, pile driving. Creosote residue from timber piles. Engine exhaust discharges from crew/supply boats and and tugs.	Same as Bay/Sound.	Sediment disruption during construction of platform. Creosote residue from timber piles. Engine exhaust discharges from crew/supply boats and tugs.	Same as Bay/Sound
of igh of ease es	Local disturbance of currents around barges and boats. Increase in water velocities due to canal-open water connection.	Local distruance of currents around rig and service craft.	Same as Jack-up.	Same as Jack-up.
wetland	Not applicable.	Not applicable	Not applicable.	Not applicable.
nd material out could er ent	Loss of 0.2 acres of habitat under jackup legs, 0.4 to 0.7 acres under hull of submersible; fouling community habitat created on underwater portions of both rigs; localized turbidity during rig placement.	Continued loss of benthic habitat.	Minimal additional benthic area disturbed by platform legs; extremely localized. short-term turbidity increase during platform emplacement; fouling community habitat created on legs of platform.	Continued loss of benthic habitat for drilling period.
	Same as Bay/Sound.	Same as Bay/Sound.	Same as Bay/Sound.	Same as Bay/Sound.
	Not applicable.	Same as Bay/Sound.	No discernible impact.	Same as Bay/Sound.
	Emissions from drill rig and support vehicles. Includes rig activity during completion and workover. Emissions (in tons per year): TSP (13.92), SO2 (26.105), CO (162.91), THC (2.95), and NOX (390.75).			
Noise able eptor	Noise level increase due to marine traffic and possible transport by helicopter. Large tug, loaded: 54-55 dBA (L_{50}) 100 ft. Tug alone: 47 dBA (L_{50}), 100 ft. Motorboat: 80 dBA (avg.) 50 ft. Helicopter: 70-90 dBA, 1000 ft.	Same as Bay/Sound.	Same as Jack-up.	Same as Bay/Sound.

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SUMMARY OF ENVIRONMENTAL
PRODUCTION IN MOBI

PARAMETER	WELL COMPLETION	PLATFORM CONSTRUCTION	GATHERING SYSTEM ESTUARINE ECOSYSTEM
WATER QUALITY	Sediment resuspension and engine exhaust discharges from crew/supply boats and tugs. Resuspension of sediments from construction related activities.	Sediment disruption during construction of platform. Creosote residue from timber piles. Engine exhaust discharges from crew/supply boats and tugs.	In estuarine ecosystems, sediment resuspension from dredging. Release of nutrients and oxygen demand from sediments. Local changes in bottom water salinity. In wetland ecosystems sediment movement resulting in some leaching of nutrient metals and humic material
HYDROLOGY	Local obstruction of currents by barge/boat.	Local obstruction of current by barge/boat.	In estuarine ecosystems, local obstruction of current by barge/boat. Local changes in bottom water circulation.
WETLAND ECOSYSTEM	Continued loss of wetland habitat.	Continued loss of wetland habitat (no additional area disturbed).	Not applicable.
AQUATIC ECOSYSTEM	Continued effects as for drilling if drilling rig used; localized turbidity increase if smaller rig brought in to replace drilling rig.	Effects the same as for drilling platform.	Loss of 4 1/2 acres of benthic habitat per 1000 feet of pipeline during construction; turbidity effects to benthic communities adjacent to dredging area.
WASTE WATER DISPOSAL	Sanitary wastes from personnel, stormwater runoff from platforms, bilge and ballast water from boats and barges. No discharge; waste is stored on barges and hauled to treatment plants for disposal.	Same as Well Completion.	Same as Well Completion.
GROUNDWATER	Possible aquifer contamination from formation additives due to unintentional fracturing of and subsequent communication through aquicludes. Potential for introduction of hydrocarbon and formation waters and additives by casing ruptures during fracturing.	Not applicable.	No discernible impact.

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TABLE 2-9
NVIRONMENTAL LOADINGS AND GENERIC EFFECTS OF
ON IN MOBILE BAY AND MISSISSIPPI SOUND

NG SYSTEM / TEM	CONSTRUCTION WETLAND ECOSYSTEM	BARRIER ISLAND	NORMAL OPERATION OF WELLS AND PIPELINE GATHERING SYSTEMS	WELL WORKOVER
systems, sion Release oxygen ments. bottom in wet- sediment ng in nutrients, materials.	Sediment resuspension and engine exhaust discharges from crew/ supply boats and tugs.	Sediment resuspension from dredging in surf zone or drill site preparation. Engine exhaust discharges from crew and supply boats. Localized effect from lost drilling mud at exit site for boring method.	Sediment resuspension and engine exhaust discharges from crew/ supply boats and tugs.	Sediment resuspension and engine exhaust discharges from crew/ supply boats and tugs.
ystems, of boat. bottom	Channelization of water through pipeline trenches would occur.	Local obstruction of current by vessels.	Local obstruction of current by rig/barge/ boat. Local circulation changes in dredge areas.	Local obstruction of currents by barge/boat.
	About 1 acre disturbed per 1000 feet of gathering system (1/3 acre for dredged trench, 2/3 acre for work area and dredged material stock pile).	Same as Wetland Ecosystem column if trench and cover method used. No effect if boring method used.	Continue loss of wetland habitat in canal and slip; beginning of salt marsh recovery along gathering system.	No additional wetland effects.
s of during t	Not applicable.	Short term disturbance of benthic community in trench corridor. Slight effect at drilling site and exit site with boring method.	No new disturbances to benthic communities gathering line corridor would recolonize but uneven bottom after refilling trench could alter recolonization.	No additional disturbance if production platform used; for new rig, effects would be same as for drilling.
tion.	Same as Well Completion.	No discharge from drilling vessel. Discharges allowed by regulation from service vessels.	Formation waters separated at processing plant and/or deep-well injected. Sanitary waste at processing plant treated and disposed through septic tank system or municipal wastewater treatment system.	Same as Well Completion.
ct.	Possible contamination of shallow aquifer due to pipeline failure.	No effect likely from trench and cover method. Possible for some salt water intrusion with boring method.	Possible contamination of aquifers by communication between strata or failure of injection well integrity during injection of produced waters.	Same as exploratory drilling with generally reduced activities on the addition of formation additives.

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TABLE 2-10

SUMMARY OF ENVIRONMENTAL LOADINGS AND GENERIC EFFECTS OF WELL FIELD ABANDONMENT IN MOBILE BAY AND MISSISSIPPI SOUND

Parameter	Well Site	Pipelines
Water Quality	Sediment disruption from removing facilities. Sediment resuspension from refilling access canals to original contours. Concomitant increase in turbidity and release of nutrients and oxygen-demanding organics. Sediment resuspension in shallow waters and engine exhaust discharges from supply/crew boats.	Sediment disruption from removing above ground structures. Pipelines remain in ground.
Hydrology	Local obstruction of tidal currents from moored barges and boats. Shell pads remaining following abandonment could alter local navigation and fishing patterns.	Not affected
Wetland Ecosystem	Canal and slip refilled, recovery of wetland vegetation.	Not affected.
Aquatic Ecosystem	Short-term turbidity increase with potential effects on seagrass beds; any shell pad could become substrate for oyster larvae.	Not affected.
Wastewater Disposal	Sanitary wastes from personnel stored in tanks/barge and hauled to treatment plant for processing and disposal.	Flushing fluids collected at processing plant.
Groundwater	Possibility of improperly plugged well providing conduit for formation waters to flow to surface and impact shallow aquifers through infiltration, or loss directly from abandoned well to freshwater aquifer.	No discernible impact.
Air Emissions	Emissions from service vehicles. Emissions (in tons per year): TSP (.003), SO2 (.006), CO (.05), HC (.008) and NOX (.004).	
Noise	Noise level increase due to general construction activities: Welding: 77 dBA (average) Backhoe: 85 dBA, 50 ft.	Same as well sites but only applicable to above ground structures. Pipes remain in ground.
Solid Waste	Generation of general construction waste. Impact minimal. Disposed of at an approved site.	Same as well site for above ground structures. Pipes remain in ground.
Socioeconomic Characteristics	Termination of severance taxes and royalties collected by and distributed from the state. A crew about the same size as in platform installation would remove structure. 4-10 people could dismantle mooring and piles. Backfilling could be necessary in salt marsh, local crew could be used.	Small crew, possibly local labor, would flush and clean the line.
Navigation	Increased waterway traffic for equipment removal and any restoration efforts, estimated maximum increase: 5 trips per day (2 barges, 3 crew boats); rig or platform removal would remove potential hazard to navigation.	Not affected.

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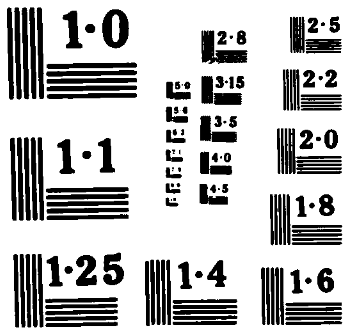

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MICROCOPY RESOLUTION TEST CHART

TABLE 2-11

SUMMARY OF THE EFFECTS OF SPILLS OF MATERIAL OR RELEASE TO THE ATMOSPHERE OF NATURAL GAS CONTAINING H_2S IN MOBILE BAY AND MISSISSIPPI SOUND

ACCIDENT	EFFECT
	-DRILLING-
Spills	
Crude Oil	Low probability of encountering oil in formations under Bay or Sound. Large uncontained spill, if one occurred, could cause extensive mortality in area receiving oil. Oil reaching sediments and salt marshes could remain for many years.
Fuel Oil	Typically 75,000 to 100,000 gallons in drilling rig storage tanks. 40,000 gallons in fuel transport barges. Effects of spill would be similar to crude oil spill.
Chemicals	Volumes spilled would be small. Effects, if any, would be localized because of dilution.
Drilling Fluids	Most material would sink to bottom at site of spill. Turbid plume of small quantity of material would extend away from site. Effect would depend on location of accident. Oyster reefs would be more sensitive than other locations. Most effects would be localized.
Natural Gas Containing H_2S	Most gas would bubble to surface. Methane would be only sparingly soluble. Hydrogen sulfide could reach concentration greater than 0.5 ppm hazardous to marine organisms. Would be oxidyzed and diluted fairly rapidly. Large crater could form at well site if casing has been breached below sediment surface. Extensive resuspension of sediments and redeposition around crater.
Atmospheric Release of Gas Containing H_2S	Well blowouts are more likely to occur where they affect oil company personnel. In general, procedures for minimizing the likelihood of such an event have been well documented and safety training is an integral part of oil rig personnel. Concentrations usually are less than 100 ppm relatively close to the source. The hazard is dependent upon the distance between the location of the accident and the prevailing wind at the time of the accident, regardless of the geographical area.
	H_2S is heavier than air, but normally it is released under pressure and mixed with methane which is lighter than air. Initially, there would be some vertical distribution of the H_2S because of mixing with methane. Most regulatory agencies require that the applicant show a "fail-safe" or emergency planning analysis which would preclude major hazards to the public or flora and fauna. Generally, the belief is that concentrations greater than 10.0 ppm over 8 hours should be avoided.
Socioeconomic Characteristics	Tourism and recreation industries in study area are vulnerable to significant economic losses from an accident. Mississippi lodging and sport fishing is worth $183 million annually. Alabama coast accounts for $625 million of state tourist industry.
	- PRODUCTION -
Spills	
Well Servicing	Solvents and materials used in small volumes would be very localized.
Pipeline Rupture	Could release crude oil (if discovered in region), natural gas containing hydrogen sulfide and/or corrosion inhibitor. Effects of crude oil or natural gas would be the same as in the drilling phase. Spill of corrosion would be like the spill of a heavy crude oil.
Well Workover	Activities are similar to drilling phase. Spills would be similar to those described for drilling.
Pipeline Rupture Releasing Natural Gas Containing H_2S	Studies of various site, pressure and duration pipeline ruptures indicate that up to 11 million cubic feet of H_2S gas may be released. Under these conditions, concentrations between 117 and 154 ppm have been calculated at distances equal to or less than 200 meters from the break.
	H_2S is heavier than air, but normally it is released under pressure and mixed with methane which is lighter than air. Initially, there would be some vertical distribution of the H_2S because of mixing with methane. Most regulatory agencies require that the applicant show a "fail-safe" or emergency planning analysis which would preclude major hazards to the public or flora and fauna. Generally, the belief is that concentrations 0.1 ppm for 1 hour should be avoided.
Socioeconomic	Same as drilling.

TABLE 2-12

SUMMARY OF ENVIRONMENTAL LOADINGS AND GENERIC EFFECTS OF THE USE OF SEISMIC SURVEY BOATS FOR GEOPHYSICAL EXPLORATION IN ALABAMA AND MISSISSIPPI STATE WATERS OF THE GULF OF MEXICO

Parameter	Effect
Surface Water Resources	Same as for seismic survey boats in Mobile Bay and Mississippi Sound (see Table 5-1).
Aquatic Ecosystem	Slight disturbance from survey boat and air gun operations.
Wastewater Disposal	Discharges from the boats with sanitation devices approved by the U.S. Coast Guard are allowed. Effects are localized and short-term. Boats without toilet facilities are not affected by Coast Guard regulations.
Air Emissions	Emissions from survey vehicles (in tons per year): TSP (.582), SO_2 (.423), CO (13.776), HC (1.28) and NOX (1.38).
Noise	No discernible impact. Noise levels similar to ambient marine traffic.
Solid Waste	Not applicable.
Socioeconomic Characteristics	15-16 people needed on 2 vessels; 2-3 could be local hires. Interaction with shore is intermittent; mostly purchases of food, fuel and minor repairs.
Navigation	Potential impact from survey boat towing two-mile long seismic cable.

TABLE 2-13

SUMMARY OF ENVIRONMENTAL LOADINGS AND GENERIC EFFECTS OF DRILLING IN ALABAMA AND MISSISSIPPI STATE WATERS OF THE GULF OF MEXICO

Parameter	Jackup and Submersible Drilling Rig		Fixed Platform	
	Site Preparation	Routine Operation	Site Preparation	Routine Operation
Water Quality	Sediment disruption by legs of jack-up rig, pile driving. Creosote residue from timber piles. Engine exhaust discharges from crew/supply boats and tugs.	Engine exhaust discharges from crew/supply boats and tubs.	Sediment disruption during construction of platform. Creosote residue from timber piles. Engine-exhaust discharges from crew/supply boats and tugs.	Engine exhaust discharges from crew/supply boats and tugs.
Hydrology	Local disturbance of currents around barges and boats.	Local disturbance of currents around rigs, barges and boats.	Same as Jack-up.	Same as Jack-up.
Aquatic Ecosystem	Temporary Loss of 0.2 acres of benthic habitat under jackup legs, 0.4 to 0.7 acres under hull of submersible; fouling community habitat created on underwater portions of both rigs; localized turbidity increase during rig placement.	Continued loss of benthic habitat for drilling period.	Very small amount of benthic area disturbed by platform legs; localized short-term turbidity increase during platform emplacement; fouling community habitat created on legs of platform.	Continued loss of benthic habitat for drilling period.
Wastewater Disposal	Sanitary wastes from personnel, stormwater runoff from platforms. No harmful discharge allowed to state waters.[1] Waste is stored on barges and hauled to treatment plants or to Federal Gulf waters if approved for disposal.	Sanitary wastes from personnel, stormwater runoff from platforms, bilge and ballast water from boats and barges, drilling mud liquids and formation water. No harmful discharge allowed to state waters[1]; Waste is stored on barges and hauled to treatment plants or to Federal Gulf waters if approved for disposal.	Same as Jack-up.	Same as Jack-up.
Groundwater	Not applicable.	Possible contamination of freshwater aquifer by exposure to drilling muds, formation waters or hydrocarbons through improperly sealed wells, casing ruptures, or natural fractures in aquicludes. Possibility for contamination of shallow aquifers due to leachate from drilling mud disposal.	No discernible impact.	Same as Jack-up.
Air Emissions	Emissions from drill rig and support vehicles. Includes rig activity during completion and workover. Emissions (in tons per year): TSP (14.971), SO2 (27.104), CO (199.195), HC (6.256) and NOX (393.726).			

TABLE 2-13 (continued)

SUMMARY OF ENVIRONMENTAL LOADINGS AND GENERIC EFFECTS OF DRILLING IN ALABAMA AND MISSISSIPPI STATE WATERS OF THE GULF OF MEXICO

Parameter	Jackup and Submersible Drilling Rig		Fixed Platform	
	Site Preparation	Routine Operation	Site Preparation	Routine Operation
Noise	Noise level increase due to marine traffic and transport by helicopter. Large tug, loaded: 54 dBA (L_{50}, 100 ft. Tug along: 47 dBA (L_{50}), 100 ft. Motorboat: 80 dBA (avg.), 50 ft. Helicopter: 70-90 dBA, 1000 ft.	Increase in noise levels from operation of drilling equipment and support activities: Generic drill rig: 85 dBA, 100 ft.	Same as jack-up, with additional construction equipment.	Same as jack-up.
Solid Waste	No discernible impact. Dredge material from marsh remains on site for reclamation.	Production of spent drilling muds and cuttings (per av. 21,000 ft. well). Liquids: 23,500-184,000 bbl. Cuttings: 6,000-9,000 bbl. Muds: 6,000-17,000 bbl. Disposed of at an approved site	No discernible impact	Same as jack-up.
Socioeconomic Characteristics	Up to 12 people needed to bore soil. 4-10 jobs to drive piles for mooring. Extra tug crew could be contracted with 2-4 in crew. Rigging up involves typical drilling complement of 20-36 people.	Self contained operation, 20-36 people on board 24 hours a day; little if any interaction with adjacent economy. Equipment and supplies transported directly from source or shuttled through staging dock; adequate ports available in Mississippi and Alabama.	Existing regional facilities could be used to construct platform modules. 50-80 people needed to install structure offshore; only a few positions filled by locals. Tugs could be local, 2-8 people needed. 1 month to install a platform.	Same as jackup or submersible drilling rig.
Navigation	Increased waterway traffic (pile driver barge, supply barge, crew boat); estimated maximum increase: 3 trips per day (1 barge, 2 crew boats); 200 to 250 foot square work area closed to navigation.	Increased waterway traffic (mud and supply barge, crew boat); estimated maximum increase: 5 trips per day (1 supply barge, 1 waste barge, 3 crew boats); continued closure of drilling area to navigation.	Increased waterway traffic (pile driver barge, platform module barge, crew boat); estimated maximum increase: 4 trips per day (2 barges, 2 crew boats); 300 foot square work area closed to navigation.	Increased water traffic same as for jackup or submersible; continued closure of drilling area to navigation.

[1]No discharges are allowed from platforms or drilling barges with the exception of uncontaminated bilge and ballast water; discharges from marine vessels are allowed in conformance with U.S. Coast Guard regulations.

TABLE 2-14

SUMMARY OF ENVIRONMENTAL LOADINGS AND GENERIC EFFECTS OF HYDROCARBON PRODUCTION IN ALABAMA AND MISSISSIPPI STATE WATERS OF THE GULF OF MEXICO

Parameter	Well Completion	Platform Construction	Gathering System Contruction	Normal Operations of Wells and Pipeline Gathering System	Well Workover
Water Quality	Sediment resuspension and engine exhaust discharges from crew/supply boats and tugs. Resuspension of sediments from construction-related activities.	Sediment disruption during construction of platform. Creosote residue from timber piles. Engine exhaust discharges from crew/supply boats and tugs.	Sediment resuspension from dredging. Release of nutrients and oxygen demand from sediments.	Sediment resuspension and engine exhaust discharges from crew/supply boats and tugs.	Sediment resuspension and engine exhaust discharges from crew/supply boats and tugs.
Hydrology	Local obstruction of currents by barge/boat.	Local obstruction of natural currents by barge/boat.	Local obstruction of natural current by barge/boat. Local changes in bottom water circulation due to pipeline trenching.	Local obstruction of natural current by rig/barge/boat. Local changes in bottom water circulation in dredged areas.	Local obstruction of natural current by barge/boat.
Aquatic Ecosystem	Continued effects as described for drilling if existing rig used; localized turbidity increase if smaller rig used.	Effects the same as for drilling platform (localized turbidity, fouling community habitat created on platform legs).	2 1/2 acres of benthic habitat disturbed per 1000 feet by jet sled method; 4 1/2 acres disturbed per 1000 feet by hydraulic dredging method.	No new disturbances to benthic communities; gathering line corridor would recolonize but uneven bottom after refilling trench could alter community established.	No additional disturbance if production platform used; for new rig, effects would be same as for drilling.
Wastewater Disposal	Sanitary wastes from personnel, stormwater runoff from platforms, bilge and ballast water from boats and barges. No harmful discharge allowed to state waters[1]; waste from well sites is stored on barges and hauled to treatment plants or to Federal Gulf waters if approved for disposal.	Same as Well Completion.	Same as Well Completion.	Formation waters separated and deep-well injected. Sanitary wastes at processing plant treated and disposed of through septic tank system or municipal wastewater treatment system.	Same as Well Completion.

TABLE 2-14 (continued)

SUMMARY OF ENVIRONMMENTAL LOADINGS AND GENERIC EFFECTS OF HYDROCARBON PRODUCTION IN ALABAMA AND MISSISSIPPI STATE WATERS OF THE GULF OF MEXICO

Parameter	Well Completion	Platform Construction	Gathering System Contruction	Normal Operations of Wells and Pipeline Gathering System	Well Workover
Groundwater	Possible aquifer contamination from formation additives due to unintentional fracturing of and subsequent communication through aquiclides. Introduction of hydrocarbon and formation waters and additives by casing ruptures during fracturing.	Not applicable.	No discernible impact.	Contamination of shallow aquifer due to pipeline failure and deeper aquifers due to well casing rupture. Contamination of aquifers by communication between strata or failure of injection well integrity during injection of produced waters.	Same as exploratory drilling with generally reduced activities and the addition of formation additives.
Air Emissions	Emissions from service vehicles and drill rig at rates reduced from exploratory drilling and generally with a smaller rig. Temporary use of compressors and pumps. Emissions (in tons per year, not including rig): TSP (.175), SO2 (.127), CO (4.133), HC (.384) and NOX (.414).		Emissions from draglines hydraulic jet trenches and support craft. Emissions (in tons per year): TSP (.582), SO2 (.423), CO (13.78), HC (1.280) and NOX (1.380).	Emissions from pumps, compressors and flaring. Emissions (in tons per year): TSP (5.665), SO2 (3.57), CO (233.32), HC (9.16) and NOX (149.35).	Emissions from a generally smaller workover rig as compared to exploratory drilling, operating for only 3 to 8 months. Emissions (in tons per year, not including rig): TSP (.172), SO2 (.127), CO (4.133), HC (.384) and NOX (. 414).
Noise	Increase in noise levels associated with operation of generally smaller drilling rig. Also noise from pumps, compressors, lifts and boats. Motorboat: 80 dBA (avg.), 50 ft. Pumps: 76 dBA, 50 ft. Air compressor: 92-100 dBA, at source.	Increase in noise levels due to general construction activities. Welding: 77 dBA (avg.), Pneumatic tools: 90-116 dBA, operators position	Increased noise levels from dragline/backhoe equipment and marine traffic. Trenching: 88 dBA (Land average). Large tug, loaded: 54-55 dBA (with silencer) 140 dBA (without)	Intermittent noise associated with inspection and maintenance, primarily near shore for pipelines. Motorboat: an average of 80 dBA, 50 ft. Gas venting (blowdown):	Similar to noise levels of well completion (slightly increased and of shortened duration).

TABLE 2-14 (concluded)

SUMMARY OF ENVIRONMMENTAL LOADINGS AND GENERIC EFFECTS OF HYDROCARBON PRODUCTION IN ALABAMA AND MISSISSIPPI STATE WATERS OF THE GULF OF MEXICO

Parameter	Well Completion	Platform Construction	Gathering System Contruction	Normal Operations of Wells and Pipeline Gathering System	Well Workover
Solid Waste	Production of small amounts of cuttings and muds, mostly formation fluids with completion additives. Disposed of at an approved site.	No discernible impact	No discernible impact.	No discernible impact.	Production of drilling waste similar to exploratory drilling, including muds, cements, cuttings, and fracturing chemicals. Drilling fluids: 2,000 bbl/well. Disposed of at an approved site.
Socioeconomic Characteristics	Personnel increase; 28-51 on rig at once. More traffic at staging area. Additional tugs possibly needed; 2-4 jobs per vessel; local firm could be used.	20 people to prepare site. 80 workers (40 each shift) needed for installation. 40 or more to place equipment. Only a few jobs for locals if regional firm won contract. Traffic increase at staging area and retail purchases by workers to and from job. Local tugs could be used.	120 workers for 5-line offshore system, 60 in each tour; 10 could be local. Traffic increase at staging area; only minor purchases made by commuters. Right-of-way for landfall could result in a revenue influx, other effects are short term.	Average of 10 people needed to monitor platform equipment. Pipeline is mostly automated, small local crew could be used. Employment is long term. Wages would circulate locally. Severance taxes and royalties Shown in Tables 2-4 and 2-9 would be collected and benefit population and governments.	Same as initial drilling. 20-36 in a crew; little interaction with adjacent community. Operation would last at least several weeks.
Navigation	Increased waterway traffic (supply barge, crew boat); estimated maximum increase: 8 trips per day (2 barges, 6 crew boats).	Increased waterway traffic (derrick barge, supply barge, crew boat); estimated maximum increase (at start of platform installation): 8 to 9 trips per day (3 barges, 5 to 6 crew boats).	Potential navigation impact while trenching across Intracoastal Waterway; dredged material pile next to pipeline trench in shallow water areas near shore could block waterway traffic until trench is refilled.	Few potential effects expected.	Increased waterway traffic same as for routine operations during drilling.

[1]No discharges are allowed from platforms or drilling barges with the exception of uncontaminated bilge and ballast water; discharges from marine vessels are allowed in conformance with U.S. Coast Guard regulations.

TABLE 2-15

SUMMARY OF ENVIRONMENTAL LOADINGS AND GENERIC EFFECTS OF WELL FIELD ABANDONMENT IN ALABAMA AND MISSISSIPPI STATE WATERS OF THE GULF OF MEXICO

Parameter	Well Site	Pipelines
Water Quality	Sediment disruption from removing facilities. Sediment resuspension from refilling access canals to original contours. Concomitant increase in turbidity and release of nutrients and oxygen-demanding organics. Sediment resuspension in shallow waters and engine exhaust discharges from supply/crew boats.	Possible sediment disruption from removing above ground structures. Pipelines remain in ground.
Hydrology	Local obstruction of tidal currents from moored barges and boats. Remaining shell pads could alter local navigation and fishing patterns.	Not affected.
Aquatic Ecosystem	Localized, short-term turbidity increase and benthic disturbance when production platform removed. Rapid recovery of small area disturbed. Remaining pad material would serve as substrate for oysters.	Pipeline abandoned in place. No environmental disturbance.
Wastewater Disposal	Sanitary wastes from personnel stored in tanks/barge and hauled to shore for processing and disposal or treated and discharged to Federal waters.	Flushing fluids collected at processing plant.

TABLE 2-15 (Concluded)

SUMMARY OF ENVIRONMENTAL LOADINGS AND GENERIC EFFECTS OF WELL FIELD ABANDONMENT IN ALABAMA AND MISSISSIPPI STATE WATERS OF THE GULF OF MEXICO

Parameter	Well Site	Pipelines
Groundwater	Possibility of improperly plugged well providing conduit for formation waters to flow to surface and impact shallow aquifers through infiltration, or loss directly from abandoned well to freshwater aquifer.	No discernible impact.
Air Emissions	Emissions from service vehicles. Emissions (in tons per year): TSP (.087), SO^2 (.063), CO (2.07), HC (.192) and NOX (.207).	
Noise	Noise level increase due to general construction activities: Welding: 77 dBA (average). Backhoe: 85 dBA, 50 ft.	Same as well sites but only applicable to above ground structures. Pipes remain in ground.
Solid Waste	Generation of general construction waste. Impact minimal. Disposed of at an approved site.	Same as well site for above ground structures. Pipes remain in ground.
Socioeconomic Characteristics	Termination of severance taxes collected by and distributed from the state. Crew size to remove platform about the same as in installation.	A small crew, possibly local labor, would flush and clean the line. Line abandoned in place.
Navigation	Increased waterway traffic for equipment removal; estimated maximum increase: 5 trips per day (2 barges, 3 crew boats).	Not affected.

TABLE 2-16

SUMMARY OF ENVIRONMENTAL LOADINGS AND GENERIC EFFECTS OF SPILLS OF MATERIAL OR RELEASE TO THE ATMOSPHERE OF NATURAL GAS CONTAINING H_2S IN ALABAMA AND MISSISSIPPI STATE WATERS OF THE GULF OF MEXICO

ACCIDENT	EFFECT
	-DRILLING-
Spills Crude Oil	Low probability of encountering oil in formations under state waters of the Gulf of Mexico. Effects of a large uncontained spill, if one occurred, would depend on wind direction, sea state, season and other factors at time of spill. Spill during winter and early spring spawning season could cause some mortality of eggs, larvae and juveniles. Weathering, evaporation and dilution would reduce toxic aromatic content. Residual tar balls could remain in sediments for up to a year and be transported onto beaches.
Fuel Oil	Typically 75,000 to 100,000 gallons in drilling rig storage tanks. 40,000 gallons in fuel transport barges. Effects of spill would be similar to crude oil spill.
Chemicals	Volumes spilled would be small. Effects would be negligible because of dilution.
Drilling Muds	Most material would sink to bottom at spill site. Turbid plume of small quantity of material would extend away from site. Material would be spread out by storm events. Effects would be localized. Ocean disposal of muds and fluids allowed from rigs beyond 3 mile limit of state waters.
Natural Gas Containing H_2S	Most gas would bubble to surface. Rapid dilution would minimize effects. Large crater could form at well site if casing has been breached below sediment surface. Extensive resuspension of sediments and redeposition around crater.
Atmospheric Release of Gas Containing H_2S	Same as Mobile Bay and Mississippi Sound.
Socioeconomic Characteristics	Tourism and recreation industries could be adversely affected. Alabama coast accounts for $625 million spent annually on tourism. Lodging and sports fishing in Mississippi is worth $183 million per annum. Economic losses would be likely if an accident occurred.
	PRODUCTION
Spills Well Servicing	Solvents and materials used in small volumes. Effects unlikely because of rapid dilution.
Pipeline Rupture	Could release crude oil (if discovered in region), natural gas containing hydrogen sulfide and/or corrosion inhibitor. Effects of release of crude oil or natural gas would be the same as in the drilling phase. Spill of corrosion inhibitor would be like the spill of a heavy crude oil.
Well Workover	Activities are similar to drilling phase. Spills would be similar to those described for drilling.
Pipeline Rupture Releasing Natural Gas Containing H_2S	Same as Mobile Bay and Mississippi Sound.
Socioeconomic Characteristics	Same as drilling.

TABLE 2-17

SUMMARY OF ENVIRONMENTAL LOADINGS AND GENERIC EFFECTS OF DRILLING FROM AN UPLAND SITE IN COASTAL ALABAMA AND MISSISSIPPI

Parameter	Site Preparation	Routine Operations
Water Quality and Hydrology	Runoff from spoil piles, drilling rigs and trenches may include sediment, waste fuels, waste oils chemicals.	
Upland Ecosystems	1/2 acre cleared per 1000 feet of access road; 1 acre cleared for drilling activities; in both areas, wildlife habitat would be lost for the life of the project.	No additional area disturbed.
Wastewater Disposal	Sanitary wastes would be stored, treated and discharged below ground, treated on-site and discharged to the nearest water body, or hauled to a treatment plant for treatment and disposal.	Drilling muds/fluids may be disposed of in lagoons or de-watered and transported to a landfill; in either case, liquid would need to be dis-charged to a water body or to a treatment plant.
Groundwater	Alteration of near surface hydrological process from earth moving activities.	Possible contamination of freshwater aquifer by exposure to drilling muds, formation waters or hydrocarbons through improperly sealed wells, casing ruptures, or natural fractures in aquicludes. Possible con-tamination of shallow aquifers due to use of on-site mud storage pits, or infiltration of brine for emergency brine storage pits if liner is breached.
Air Emissions	Emissions from drilling equipment, dredge equipment, miscellaneous construction activities and transportation. Includes rig activities during completion and workover. Emissions (in tons per year): TSP (13.47), SO2 (26.14), CO (163.21), HC (3.0) and NOX (390.1)	
Noise	Increase in noise levels due to land clearing activities and transportation. Dozer: 80 dBA, 50 ft. Chain saw: 83 dBA (avg.), 50 ft. Medium-heavy duty trucks: 84 dBA, 50 ft.	Increase in noise levels from operation of drilling equipment and support activities: Generic drill rig: 85 dBA, 100 ft. (level rig may be higher due to radiator fan noise).
Solid Waste	Biomass from land clearing disposed of on site or at an approved landfill.	Production of spent d-'lling muds and cuttings (per av. 21,000 ft. well): Liquids: 23,500-184,000 bbl. Cuttings: 6,000-9,000 bbl. Muds: 6,000-17,000 bbl. Disposed of at an approved site
Socioeconomic Characteristics	Land-based oil and gas infra-structure in region is currently developed, not a new activity. 15-30 workers to clear access and site, some local hires. 15-30 in all drilling shifts rig up. 8-16 truck drivers and helpers to transport rig. Traffic increases at access and site.	8-10 people for each of 3 8-hour shifts, fourth crew fills in as needed. Workers within a hundred miles would be likely to commute daily or stay during the week, not move. Small retail pur-chases made by commuters, residents' wages circulated locally.

PARAMETER				
WATER [illegible] AND WASTEWATER [illegible]	[illegible] wastes [illegible] waters [illegible] wastes [illegible] treatment [illegible] disposal.	[illegible] wastes from [illegible] treatment plant [illegible] processing [illegible]	[illegible]	[illegible]
PLANT [illegible] SYSTEM	[illegible] disturbed	[illegible] feet [illegible] wildlife habitat [illegible] this area.	[illegible]	[illegible]
[illegible] WATER	Possible aquifer contamination from [illegible] due to [illegible] and subsequent [illegible] waters and [illegible] ruptures during [illegible]	No discernible impact.	[illegible]	[illegible]
AIR [illegible]	Emissions [illegible] vehicles and [illegible] at rates [illegible] exploratory drilling [illegible] generally [illegible] compressors and pumps [illegible]	Emissions from [illegible]		
[illegible]	[illegible] compressors [illegible]	[illegible]	[illegible]	

TABLE 2-18

VIRONMENTAL LOADINGS AND GENERIC EFFECTS FROM HYDROCARBON PRODUCTION ACTIVITIES OCCURRING ON UPLANDS IN COASTAL ALABAMA AND MISSISSIPPI

ACTIVITY	NORMAL OPERATION UPLAND GATHERING SYSTEM	NORMAL OPERATION TREATMENT FACILITY	UPLAND WELL WORKOVER	UPLAND ENHANCED RECOVERY FACILITIES	SERVICE BASES	RES[illegible] TRANSFER MARKET
from struc- wastes stored led to for disposal.	Not applicable.	Sanitary wastes, produced brines, site runoff, cooling water, boiler water. Wastes may be discharged to surface waters after treatment required by NPDES permit, injected into deep wells, or discharged to a sanitary sewer for treatment and disposal at a municipal treatment plant. Small, unavoidable spills would occur.	Sanitary wastes from personnel, runoff from site production waters and mud liquids. Wastes stored on-site or piped to treatment plant for processing and disposal. Small, unavoidable spills would occur.	Sanitary wastes from personnel, runoff from site production waters and mud liquids. Wastes stored on-site or piped to treatment plant for processing and disposal. Small, unavoidable spills would occur.	Altered runoff characteristics wastewaters and unavoidable, small spills are generated.	Small, unavoidable spills would occur.
30 red res for ered	Regrowth of grasses and small shrubs; continued maintenance would not allow regrowth of trees and large large woody shrubs.	Continued loss biological productivity under structures and paved areas for life of project.	No additional area disturbed.	Gas lift: wildlife habitat lost for new well [illegible] acre) and new pipeline (1 to 1 3/4 acres per 1000 feet of line); Material injection: additional 1/4 acre may be created to store material to be injected.	No effect of existing facilities used; expansion or creation of new facilities could affect 30 to 100 acres depending on expected activity.	Pipeline: 1 to 1 3/4 acres cleared per 1000 feet of line, loss of wildlife habitat.
mpact.	Accidents at treatment facilities and during transportation of product.	Accidents at treatment facilities and during transportation of product.	Same as exploratory drilling with generally reduced activities and the addition of formation additives.	Contamination from drilling new well. Over pressure and/or case rupture may cause loss of enhancement or formation fluids to a freshwater aquifer.	No discernible impact.	No discernible impact.
[illegible]	Emissions from pumps, compressors, transport vehicles and flaring. Emissions (in tons per year): TSP (2.14[illegible]), SO2 [illegible], [illegible], THC (10.62), and NOX [illegible].		Emissions from service vehicles and a generally smaller workover rig as compared to exploratory drilling operating for only 3 to 8 months. Emissions (in tons per year, not including rig): TSP (.087), SO2 (.063), CO (2.088), THC (.192), and NOX (.208).	Emissions from pumps and compressors and associated transportation activities, assuming no new wells are drilled. Emissions (in tons per year): TSP (1.97), SO2 (.143), CO (4.674), THC (.431), and NOX (.465).		
tation	Intermittent noise associated with inspection and maintenance of pipelines, operation of treatment facilities/service bases and transportation of product by truck. Flare stack: 81-96 dBA, 20 ft. Generator: 90 dBA, 0 ft. Pump: 80-90 dBA, operator's position. Air Compressor: 90-100 dBA4 dBA, 50 ft. Medium heavy-duty truck: 8k: 62 dBA [illegible]. Large tug with barge at [illegible]		Similar to increased noise from well completion, slightly increased and generally of a shortened duration (3 to 8 weeks).	Increased noise levels due to the use of compressors and pumps and service vehicles. Pump: 76 dBA, 50 ft. Air compressor: 92-100 dBA Medium heavy-duty truck: 84 dBa, 50 ft. No pump/compressor noise if pressurized gas is recycled (via pipes) from treatment plant.	Increased noise levels similar to those of normal operations of gathering systems and treatment facilities.	

2

TABLE 2-16

SUMMARY OF ENVIRONMENTAL LOADINGS AND GENERIC [illegible]

OCCURRING ON UPLANDS IN COASTAL [illegible]

PARAMETER	UPLAND WELL COMPLETION	FACILITY CONSTRUCTION GATHERING SYSTEM	OIL TREATMENT FACILITY	GAS TREATMENT FACILITY	NORMAL UPLAND GATHERING SYSTEM
SOLID WASTE	Production of small amounts of cuttings and muds, mostly formation fluids with completion additives. Disposed of at an approved site.	General construction waste.	General construction waste.	General construction waste.	No discernible impact.
SOCIOECONOMIC CHARACTERISTICS	One of busiest phases, workers on site at once would increase, as would traffic. Land-based service industry in region, so increases would be in line with established practices. Completion indicates that resources are available for taxation and royalties.	30 to 100 jobs, 35% to 60% could be local hires. Employment is transitory. Traffic increases at meeting points. Potential local purchases of materials. Land acquisition could result in monetary influx.	5 to 15 acres for plant; 50 acres could be acquired. Employment for 10 to 150, more than 1/2 could be local hires. Wages circulated and taxed. Possible inmigration; larger communities could absorb addition with little if any stress on resources. Traffic increases at and around site.	20 to 75 acres acquired, more if larger buffer is needed. 25 to 550 workers; most could be local hires. All effects same as for oil processing plant.	Operation highly automated; small workforce needed for monitoring and right-of-way maintenance.

TABLE 2-18 (Concluded)
-NTAL L ADINGS AND GENERIC EFFECTS FROM HYDROCARBON PRODUCTION ACTIVITIES
CCURRING ON UPLANDS IN COASTAL ALABAMA AND MISSISSIPPI

	NORMAL OPERATION		UPLAND WELL	UPLAND ENHANCED		RESOURCE TRANSPORT
TY	UPLAND GATHERING SYSTEM	TREATMENT FACILITY	WORKOVER	RECOVERY FACILITIES	SERVICE BASES	MARKET
m	No discernible impact.	Small volumes of sediment material produced from oil treatment tanks and piping. For a 225 MMCFD gas processing plant, one barrel per day of sulfinol process waste. Three to 5 tons/year of miscellaneous solid waste produced. Some of which may be classified hazardous if produced in sufficient quantities and not reclaimed. Small volumes of industrial waste produced at service bases.	Production of drilling waste similar to exploratory drilling, including muds, cements, cuttings, and fracturing chemicals. Drilling fluids: 2,000 bbl/well. Disposed of at an approved site.	No discernible impact, assuming no new wells are drilled.	Construction debris would be major form of solid waste during construction. Wastes from operations would include dunnage, 6.5 lbs of garbage per person per day.	No discernible impact.
l t.	Operation highly automated; small workforce needed for monitoring and right-of-way maintenance.	Permanent employment for 15-35 people. Wages locally circulated and taxed, as shown in Tables 2-4 and 2-9.	Same as initial drilling operations.	If new pipeline needed same as initial pipeline. If new wells are needed same as initial drilling. Could expand treatment facility then small construction workforce needed. Effects short lived.	5 to 10 acres most used for open storage. Improvements could require workforce of 20 to 90. Space usually rented. 2 to over 50 people needed during operation; many local hires. Wages and taxes circulated locally.	If new pipeline is needed, employment opportunities would be the same as initial gathering system.

2

TABLE 2-19

SUMMARY ENVIRONMENTAL LOADING AND GENERIC EFFECTS OF ABANDONMENT OF UPLAND HYDROCARBON DRILLING AND PRODUCTION FACILITIES IN COASTAL ALABAMA AND MISSISSIPPI

Parameter	Upland Well Site	Pipelines	Treatment Facilities	Service Bases
Surface Water Resources	Surface runoff from decommissioning activities and waste chemicals from erosion and residual chemical/product contamination.	Pipelines remain in ground. Surface runoff and waste chemicals from decommissioning activities associated with above ground facilities.	Surface runoff and waste chemicals from decommissioning activities including erosion and residual chemical/product contamination.	
Upland Ecosystems	After equipment removal, area could be regarded and reseeded, as determined by landowner.	Future use of area determined by landowner.	Future use of area determined by landowner	Area would probably remain as a commercial or industrial area
Wastewater Disposal	Sanitary wastes from personnel treated and discharged on site or hauled to treatment plant for processing and disposal.	Flushing fluids collected, treated, and disposed of at processing facility.	Sanitary wastes from personnel may be treated and dischaged to surface waters or hauled or piped to municipal treatment plant for treatment and and disposal. Pipeline flushing fluids either treated and disposed of to deep-well injection or surface waters, or hauled or piped to industrial treatment plant for treatment and disposal.	
Groundwater	Possibility of improperly plugged well providing conduit for formation waters to flow to surface and impact shallow aquifers through infiltration, or loss directly from abandoned well to freshwater aquifer.	No discernible impact.	No discernible impact.	No discernible impact.
Air Emissions	Emissions from service vehicles. Emissions (in tons per year): TSP (.003), SO2 (.006), CO (.05), HC (.008) and NOX (.004).			
Noise	Noise level increase similar to general construction activities: Welding: 77 dBA (average) Backhoe: 85 dBA, 50 ft.	Same as well sites but only applicable to above ground structures. Pipes remain in ground.	Similar to well site, (more activity) if facility is not sold in place.	Similar to well site if facility is not sold in place.
Solid Waste	Generation of general construction waste. Impact minimal. Disposed of at an approved site.	Same as well site for above ground structures. Pipes remain in ground.	Similar to well site (more activity) if facility is not sold in place.	Similar to well site if facility is not sold in place.
Socioeconomic Characteristics	Minimum 5-7 days to move rig off site. At least 28 people employed. Traffic would increase. Cessation of severance tax and royalties to state and/or private parties.	Small crew needed to flush pipes; no appreciable effects.	Facilities could be sold for similar use, converted to another industrial use, or be removed. New use could be beneficial for local employment.	Could be converted and used in marine transportation, commercial or sport fishing, fish or wood processing or industrial park. Substituting business may or may not affect local employment, personal income taxes and local resources.

PARAMETER	MOBILE DELTA	MOBILE BAY	MISSISSI
WATER QUALITY	Cumulative effects of turbidity unlikely because of temporal and spacial separation of activities. All wastewaters and solid wastes collected and transported to land for disposal.	Cumulative effects of turbidity unlikely because of temporal and spacial separation of activities. All wastewaters and solid wastes collected and transported to land for disposal.	Cumulative effects of because of tempor of activities. All w wastes collected and for disposal.
HYDROLOGY	No cumulative effect if separate waterways are not connected.	No cumulative effects	No cumulative effects
GROUNDWATER			
WASTEWATER DISPOSAL	All sanitary wastewater from well sites collected and transported to shore for disposal. Volume generated would be 17, 19 and 24 million gallons for the low, moderate and high scenarios; small volume compared to amount generated in surrounding region.	All sanitary and wastewater from well sites collected and transported to shore for disposal. Volume generated would be 180, 230 and 170 million gallons for the low, moderate and high scenarios; small volume compared to amount generated in surrounding region.	All sanitary and wast collected and transpo disposal. Volume gen and 60 million gallon and high scenarios; s to amount generated i
NOISE	Noise levels generated by multiple drilling rigs spaced a minimum distance apart are not appreciably noisier than one drilling rig relative to an equidistant sensitive receptor (Mobile River Delta) or an offshore receptor (Mobile Bay, Mississippi Sound, Gulf of Mexico). Maximum cumulative noise levels for drilling rig operations under the worst case would be 65 to 70 dBA.	Maximum cumulative noise levels for drilling rig construction and normal operations under the worst case would be 58 to 59 dBA.	Maximum cumulative no drilling rig construc operations under the be 58 to 59 dBA.
WETLAND ECOSYSTEMS	Total forested Delta area altered would range from 205 to 510 acres depending on the combination of drilling alternative and scenario; area required for pipeline right-of-way would be similar for all scenarios and would be a significant portion of total area affected in all scenarios, decreasing from 255 acres for the low scenario to 185 acres for the high scenario; area affected by drilling would vary greatly depending on the drilling alternative used; platforms and trestle roads would only alter 15 to 30 acres, canals and slips would alter 155 to 325 acres. Use of canals and slips would eliminate primary production, detritus export and the use of the area for spawning and feeding; area altered by platforms, trestle roads and pipeline rights-of-way would have reduced primary production but the area would still be available as feeding and spawning habitat. Altered area would be less than 1 percent of forested Delta area but would be an incremental increase to the 1.7 percent already altered (excluding logging). Total non-forested Delta area altered would range from 11 to 50 acres, much of it pipeline right-of-way; pipeline area would be disturbed only temporarily since careful restoration would allow recovery of original vegetation; use of platforms and trestle roads would alter about 1 acre; canals and slips would alter 5 to 22 acres. While the total area affected would be small, it would be an incremental addition to the already large loss of non-forested Delta area (about 25 percent) that has already occurred.	Wetlands would probably not be disturbed under any scenario because adequate pipeline landfalls exist that would not require crossing wetlands; forested wetlands would be crossed between Weeks Bay and the Bon Secour River, a likely maximum of 3 corridors would disturb 1 percent of the wetland area.	Only 3 wetland areas by directional drilli bon resource estimate low probability of dri Most pipelines in the onshore between Pasca Island Bridge; carefu could minimize or avo

TABLE 2-20

SUMMARY OF ENVIRONMENTAL EFFECTS OF RESOURCE DEVELOPMENT SCENARIOS

	MISSISSIPPI SOUND	STATE WATERS OF THE GULF OF MEXICO	UPLAND
ly tion lid nd	Cumulative effects of turbidity unlikely because of temporal and spacial separation of activities. All wastewaters and solid wastes collected and transported to land for disposal.	Cumulative effects of turbidity unlikely because of temporal and spacial separation of activities. All wastewaters and solid wastes collected and transported to land for disposal.	Not applicable.
	No cumulative effects.	No cumulative effect.	Not applicable.
sites dis- 230 oderate red ion.	All sanitary and wastewater from well sites collected and transported to shore for disposal. Volume generated would be 30, 60 and 60 million gallons for the low, moderate and high scenarios; small volume compared to amount generated in surrounding region.	All sanitary wastewater from well sites collected and transported to shore for disposal. Volume generated would be 17, 19 and 24 million gallons for the low, moderate and high scenarios; small volume compared to amount generated in surrounding region.	
	Maximum cumulative noise levels for drilling rig construction and normal operations under the worst case would be 58 to 59 dBA.	Maximum cumulative noise levels for drilling construction and normal operations under the worst case would be 48 dBA.	The USEPA recommended values for residential/institutional areas are 55 to 65 dBA (L_{dn}). However, those activities that are continuous (e.g., drilling) would produce a noise level higher (L_{dn}) than the presented calculated instantaneous estimates. Other factors than can increase or decrease estimates include vegetation, atmospheric inversions, wind and ambient noise levels.
d ly imum of	Only 3 wetland areas could not be reached by directional drilling; limited hydrocarbon resource estimated for region gives low probability of drilling these areas. Most pipelines in the region would come onshore between Pascagoula and the Dauphin Island Bridge; careful planning of routes could minimize or avoid crossing wetlands.	Not applicable.	Not applicable.

2

TABLE [illegible]

SUMMARY OF ENVIRONMENTAL EFFECTS

PARAMETER	MOBILE DELTA	MOBILE BAY	MISSISSIPPI
AQUATIC ECOSYSTEMS	Little cumulative affect in main flow channels because of likely spacial and temporal separation of dredging activities for canal construction or pipeline river crossings if these methods are used; virtually no effect if boring method used for pipeline river crossings and platform drilling methods are employed. Dredging activities in shallow bays of southern Delta would occur in an area of importance as a nursery for many aquatic organisms and as waterfowl overwintering ground. Aquatic habitat created in canals and slips would add only slightly to the 30,000 acres of aquatic habitat in the Delta. *The value of this habitat is* not documented but could be low if low dissolved oxygen concentrations occur.	Main altering activity would be pipeline *construction during years 6 to 10 or 11.* Area affected by drilling sites would be very small for any drilling alternative or scenarios. Under the high and moderate scenarios, between 2300 to 2500 acres would be newly disturbed or recovering from disturbance in years 9 and 10, which is about 1 percent of the bay area; some affect on bay secondary productivity could result for that period if the disturbed area is concentrated in one portion of the bay. Dredging for well site access would probably be necessary in the shallow northern portion of the bay near the Battleship Parkway; any disturbance there would occur in an area of importance as a nursery for many species and as a waterfowl overwintering ground.	Very little activity wo[illegible] scenario; much of what [illegible] concentrated in eastern sound. Most pipeline [illegible] occur in 1 or 2 years. Mississippi do not allo[illegible] or pipelines in or near or oyster reefs; no suc[illegible] Alabama waters, but mos[illegible] are within 1/2 mile of [illegible] drilling sites are excl[illegible] bance by dredging in the of Portersville Bay an[illegible] Island Bridge could att[illegible] grounds and oyster bott[illegible]
COMMERCIAL FISHERIES	Minimal impacts expected.	Direct loss of 10 to 15 acres to any fishing; trawling operations restricted on another 50 to 100 acres; bottom irregularities or mud lumps following gathering line installation could restrict fishing boat movements or trawling activities.	Direct loss of 1 1/2 t[illegible] fishing; trawling oper[illegible] on another 6 to [illegible] acre[illegible] operations potentially [illegible] 160 acres near rig or p[illegible] irregularities or mud l[illegible] gathering line installa[illegible] restrict fishing boat m[illegible] trawling activities.
NAVIGATION	Estimated potential maximums of daily waterway traffic increases 3 to 6 barges, 15 to 30 crew boats/supply boats.	Estimated potential maximums of daily waterway traffic increases: 30 to 45 barges, 55 to 95 crew boats/supply boats; 12 to 15 platforms added as permanent structures in the Bay.	Estimated potential max[illegible] waterway traffic incre[illegible] barges, 10 to 40 crew b[illegible] boats; 2 to 5 platforms permanent structures in[illegible]
CULTURAL RESOURCES	Prior to issuing any permit for major development activities, potential impacts to known or suspected cultural resources must be resolved.	Prior to issuing any permit for major development activities, potential impacts to known or suspected cultural resources must be resolved.	Prior to issuing any pe[illegible] development activities[illegible] to known or suspected [illegible] must be resolved.

TABLE 2-20 (Concluded)

MMARY OF ENVIRONMENTAL EFFECTS OF RESOURCE DEVELOPMENT SCENARIOS

	MISSISSIPPI SOUND	STATE WATERS OF THE GULF OF MEXICO	UPLAND
ne t. be ate would dis- bout on s b- rn cur or	Very little activity would occur under any scenario; much of what would occur may be concentrated in eastern portions of the sound. Most pipeline construction would occur in 1 or 2 years. Guidelines in Mississippi do not allow drilling sites or pipelines in or near seagrass beds or oyster reefs; no such guidelines in Alabama waters, but most seagrass beds are within 1/2 mile of shore, within which drilling sites are excluded. Any disturbance by dredging in the shallow areas of Portersville Bay and near the Dauphin Island Bridge could affect shrimp nursery grounds and oyster bottoms.	Main habitat altering activity would be pipeline construction which would occur mostly in Alabama waters; activity would be spread over years 4 through 13 in high and moderate scenarios, with very little activity under low scenarios. Benthic disturbance not likely to be significant for area as a whole; concentration of construction activities in the vicinity of the inlet to Mobile Bay and near Petit Bois Pass, where most pipelines to shore are likely to enter estuarine waters, could cause some short-term loss of biological productivity in those areas during the most active years of construction. Use of common trunklines to shore from both state and Federal waters could reduce the benthic area disturbed.	Not applicable
	Direct loss of 1 1/2 to 5 acres to any fishing; trawling operations restricted on another 8 to 35 acres; purse seining operations potentially restricted on 160 acres near rig or platform; bottom irregularities or mud lumps following gathering line installation could restrict fishing boat movements or trawling activities.	Direct loss of 2 to 8 acres to any fishing; trawling operations restricted on another 10 to 55 acres; purse seining operations potentially restricted on 160 acres near rig or platform.	Not applicable.
s;	Estimated potential maximums of daily waterway traffic increases: 5 to 20 barges, 10 to 40 crew boats/supply boats; 2 to 5 platforms added as permanent structures in the Sound.	Estimated potential maximums of daily waterway traffic increases: 5 to 25 barges, 15 to 50 crew boats/supply boats; 3 to 8 platforms added as permanent structures in the state waters.	Not applicable.
to ust	Prior to issuing any permit for major development activities, potential impacts to known or suspected cultural resources must be resolved.	Prior to issuing any permit for major development activities, potential impacts to known or suspected cultural resources must be resolved.	Prior to issuing any permit for major development activities, potential impacts to known or suspected cultural resources must be resolved; some secondary development (e.g., upgrading or building a service could potentially affect cultural resources in the area of development. Prior to issuing any project permit, conflicts on potential impacts to known or suspected cultural resources must be resolved.

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TABLE 2-21

SUMMARY OF ENVIRONMENTAL EFFECTS OF ACTIVITIES ANALYZED ON A REGION-WIDE BASIS FOR THE RESOURCE DEVELOPMENT SCENARIOS

PARAMETER	EFFECT
Air Emissions	There are greater total emissions from unit offshore operations due to added support and supply requirements; difference is small from Mobile River Delta to Alabama OCS, less than 10 percent. The scenarios reveal that peak level platform activities produce downwind concentrations of greater than de minimis levels (NOX, possibly SO2 and TSP). This was true in all project geographical areas. Peak level companion processing plant capacity also produces downwind concentrations greater than de minimis levels (SO2 only). This was true in all project geographical areas. Peak level platform and processing plant activity reach or exceed significant emission rates (NOX, CO, SO2). Peak level platform and processing plant emissions will consume 50 percent of Class II increment for SO2 out to 7 km distance. Long-term modeling reveals few excesses of air quality standards; these excesses are most likely associated with potential processing plants (SO2) (close in) and close to platform (within 5-10 km) emission centers (only close in to activity), but this does not include ambient. Background suggests possible potential problems where near non-attainment exists and where 50 percent of Class II increments are now committed. Continuence of proper PSD reviews of new sources will minimize this impact.

TABLE 2-21 (Continued)

SUMMARY OF ENVIRONMENTAL EFFECTS OF ACTIVITIES ANALYZED ON A REGION-WIDE BASIS FOR THE RESOURCE DEVELOPMENT SCENARIOS

PARAMETER	EFFECT
Air Emissions (continued)	Class I areas are not affected; they are too distant from the activity. With actual ambient concentrations added to the picture, a few adjustments will likely have to be made in emissions in and near already burdened areas (by pollutant).
Groundwater	Multiple intrusions of a single aquifer pose the greatest threat to a groundwater contamination by chloride from brine disposal.
	Brine production for the highest resource development scenario (Mobile River Delta and Mobile Bay, 927.5 x 10^6 bbl) can be disposed of in approximately three square miles of the Wilcox Sand formation.
	Possible long-term contamination of fresh water aqui- fiers due to the characteristically slow discharge of pollutants by natural flushing.
Solid and Hazardous Waste	Onshore disposal of drilling muds, fluids and cuttings produced by multiple exploration and well workover drilling operations. The high resource development scenario for the entire project area will produce approximately 160,000 cubic yards of material in the most active year. A single permitted mud disposal operation in Mississippi is known to have an on-site capacity to dispose of approximately 1.38 x 10^6 cubic yards of material. Production of hazardous waste sludges from multiple gas treatment plants would result. Less than two barrels per day of semisolid hazardous waste would be produced by the high resource development scenario.

TABLE 2-21 (Concluded)

SUMMARY OF ENVIRONMENTAL EFFECTS OF ACTIVITIES ANALYZED ON A REGION-WIDE BASIS FOR THE RESOURCE DEVELOPMENT SCENARIOS

PARAMATER	EFFECT
Socioeconomic Characteristics	At a maximum as many as 24,000 laborers could be needed in year 8 for all simultaneous activities occurring in the Mobile Delta, Bay, Eastern Sound, Alabama Gulf waters and the adjacent Federal OCS. Excluding the Federal OCS, about 7,000 workers could be needed; only 3,000 positions would have the opportunity for local participation. The remainder would be associated with activities offering little, if any possibility for local involvement. Only in the highly unlikely case under the high scenario, where all employment needs are required from populations in Mobile and Jackson Counties and the surrounding community radius would immigration be likely. The EIAM indicates that in years 7 and 8 some immigration could occur. Under a more likely case under the high scenario, however, no in-migration is likely to result. Land use needs for projected hydrocarbon activity could be accommodated. Revenues from severance taxes and royalties could boost area coffers, particularly in Alabama, where revenues of as much as $20 billion over the next 30 years could be collected.

CHAPTER 3

AFFECTED ENVIRONMENT

INTRODUCTION

3.1 The affected environment consists of those areas subject to potential physical, biological or socioeconomic consequences of oil and gas development in the coastal region. For purposes of this generic environmental impact statement, the activities include anticipated levels of hydrocarbon exploration and production activities in the Mobile Delta, Mobile Bay, Mississippi Sound and the contiguous Gulf of Mexico state waters of Alabama and Mississippi. The onshore affected environment consists of Mobile and Baldwin Counties in Alabama and Hancock, Harrison and Jackson Counties in Mississippi.

3.2 To summarize the information available for this area, the affected environment has been divided into three subcategories: regional physical characteristics, subregional physical and biological characteristics and subregional socioeconomic characteristics. The regional physical characteristics include area-wide descriptions of such factors as climate, geology and air quality. The subregional physical and biological characteristics are presented for the four areas of hydrocarbon exploration and production activities. Finally, the subregional socioeconomic characteristics are presented on a county-wide basis for the five counties in the study area.

3.3 For all of the physical, biological or socioeconomic characteristics, specific details for the areas summarized in this chapter are available in the references cited in this chapter or in the documents listed in the bibliography.

REGIONAL PHYSICAL CHARACTERISTICS

3.4 The following sections include descriptions of the physical characteristics of the region as a whole, including the various aspects of climate, geology, soils, groundwater, air quality and noise as they relate to the region.

Climate

3.5 The climate of the region is temperate bordering on subtropical, with long humid summers and warm winters. Summer temperatures are frequently moderated by sea breezes from the adjacent waters. In the winter, snowfall is rare and only 15 to 20 days have temperatures below freezing. Rainfall occurs throughout the year and is generally of the shower type, although prolonged rains do occur in winter.

3.6 The average daily winter temperatures generally range from a minimum of 42°F or 43°F to a maximum of 60°F to 62°F. In the summer, the average daily temperatures range from the low 70's to low 90's. Figure 3-1 presents the annual distribution of the average daily minimums and maximums for the area. The average minimums and maximums for the region range from about 20°F in winter to 100°F in summer.

3.7 Average annual precipitation ranges from 57 inches (in the western part of the region) to 64 inches (in the eastern part). Although rainfall occurs throughout the year, greater amounts generally fall from June through September with the lowest amounts falling in October and November. Figure 3-1 presents the annual distribution for average monthly precipitation.

3.8 Prevailing winds in the region are seasonally variable with winds from the south or southwest occurring from March through August and from the north or northwest for the remainder of the year (U.S. Army Corps of Engineers, 1982a). Figure 3-2 presents the average wind speed and direction for the Mobile area.

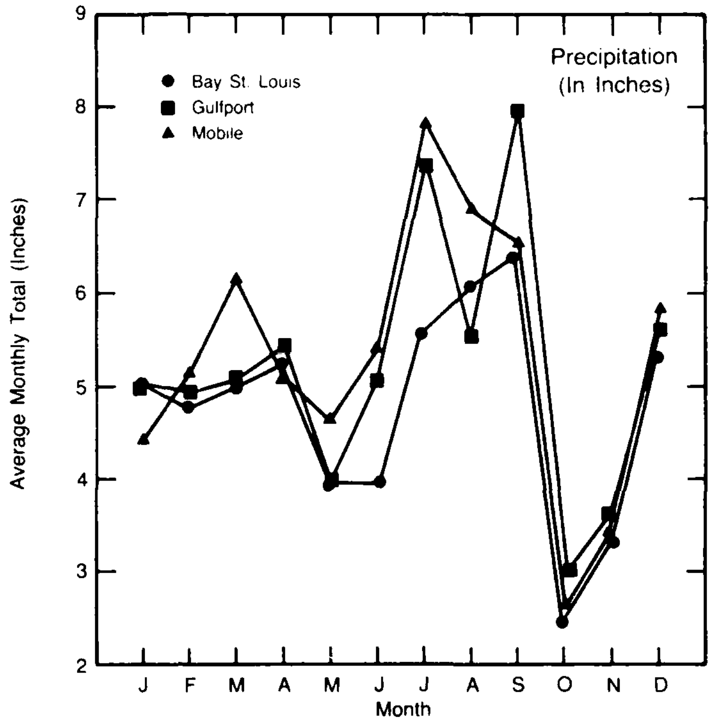
3.9 A major weather factor in the region is the seasonal possibility of damaging tropical storms or hurricanes. Hurricane Frederic in September 1979 caused considerable damage to the Alabama coastal area and Hurricane Camille in August 1969 struck the western Mississippi coast with winds up to 200 miles per hour and an accompanying storm surge of 24 feet. Figure 3-3 shows hurricane paths in the region from 1871 to 1982.

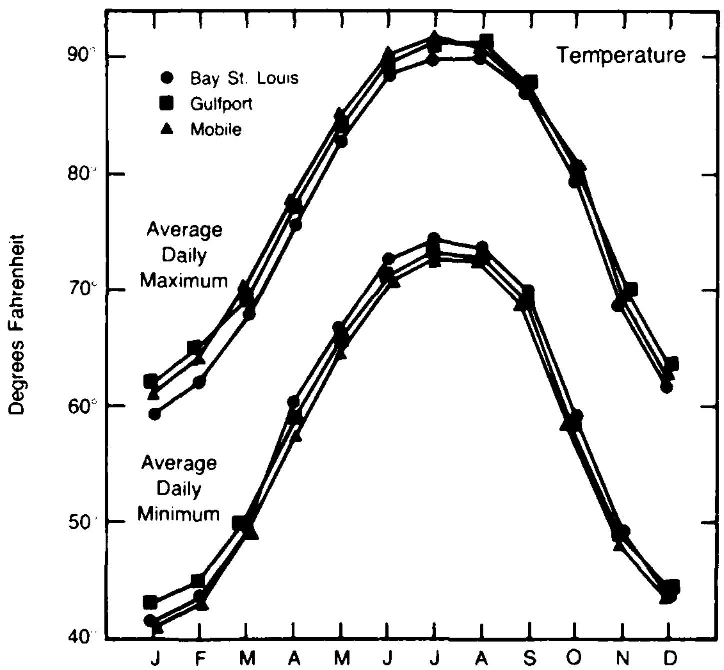
Geology

3.10 This section presents a brief description of the geology of the area with emphasis on the oil and gas developments of the region. Detailed geological discussions are included in Bicker, 1970; O'Neil and Mettee, 1982; Bolin and Masingill, 1983; and Otvos, 1976 and 1982.

Physiography

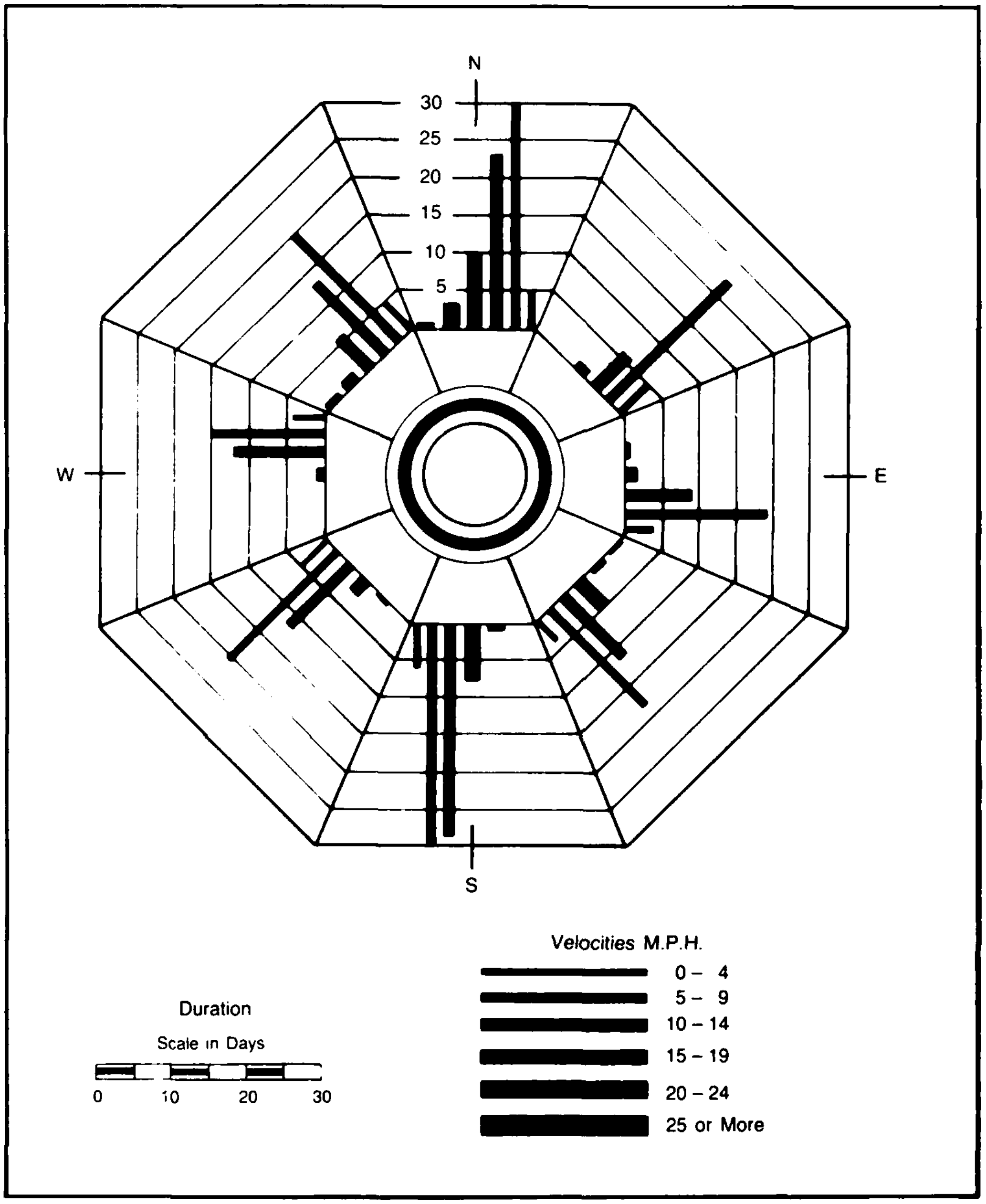
3.11 The region lies in two major physiographic provinces: the Coastal Plain and the Continental Shelf. The counties out to and including the barrier islands are in the East Gulf Coastal Plain while the area seaward of the islands is part of the Mississippi-Alabama Shelf section of the Continental Shelf (O'Neil and Mettee, 1982). The coastal portions of the counties include tidal marshes and areas described as Coastal Lowlands or Coastal Flatwoods. The county interiors are separated from the coastal area by an erosional escarpment with relief up to 100 feet. These interior areas are





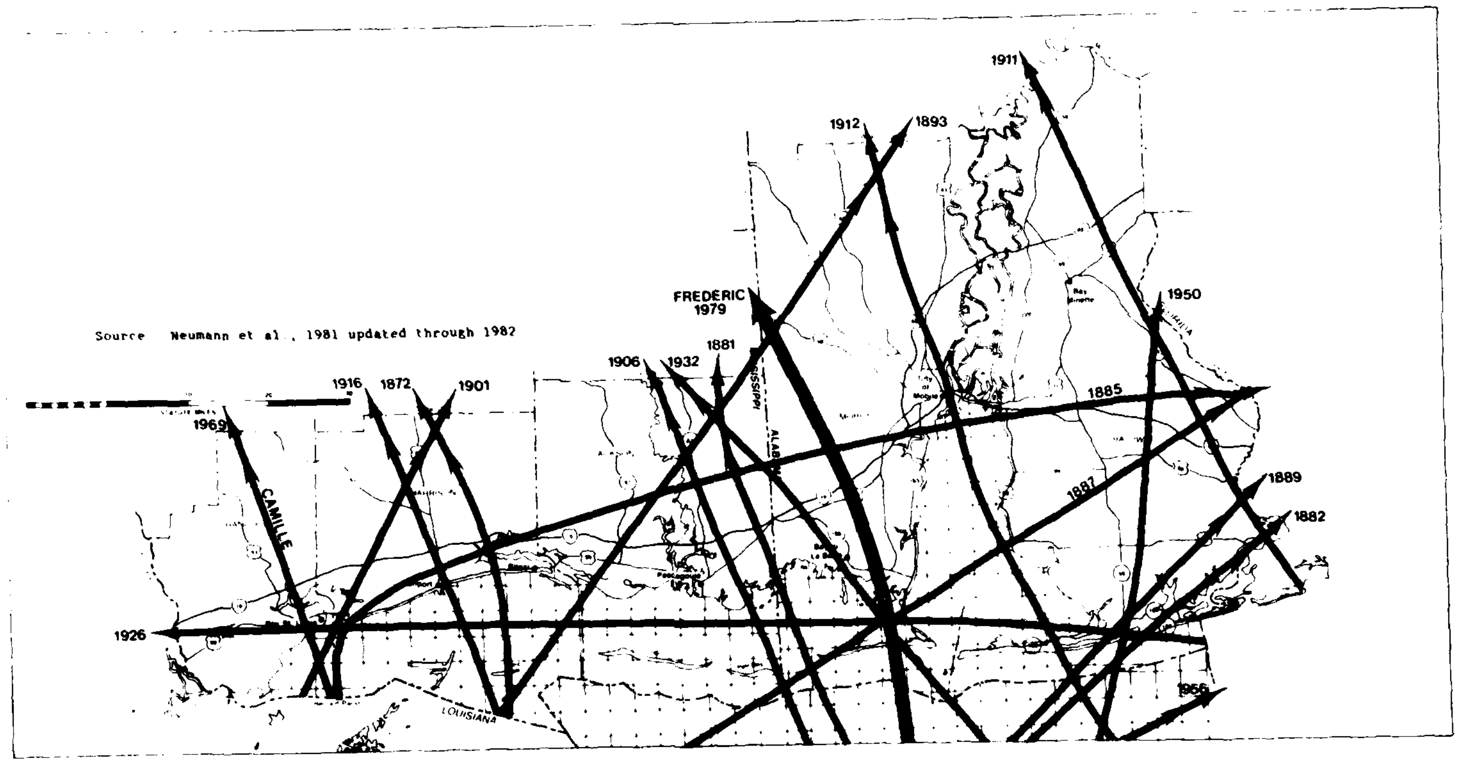
Source: U.S. Department of Agriculture, Soil Conservation Service, 1975, 1980, 1981

FIGURE 3-1
REGIONAL PRECIPITATION AND TEMPERATURE



Source U.S. Army Corps of Engineers, Undated

FIGURE 3-2
WIND ROSE FOR MOBILE, ALABAMA



Source Neumann et al., 1981 updated through 1982

FIGURE 3-3
HURRICANE PATHS 1871 – 1982

variously described as Southern Pine Hills or Coastal Plain Uplands. Elevations in the region range from sea level to 200 - 300 feet above sea level in the northern parts of the counties.

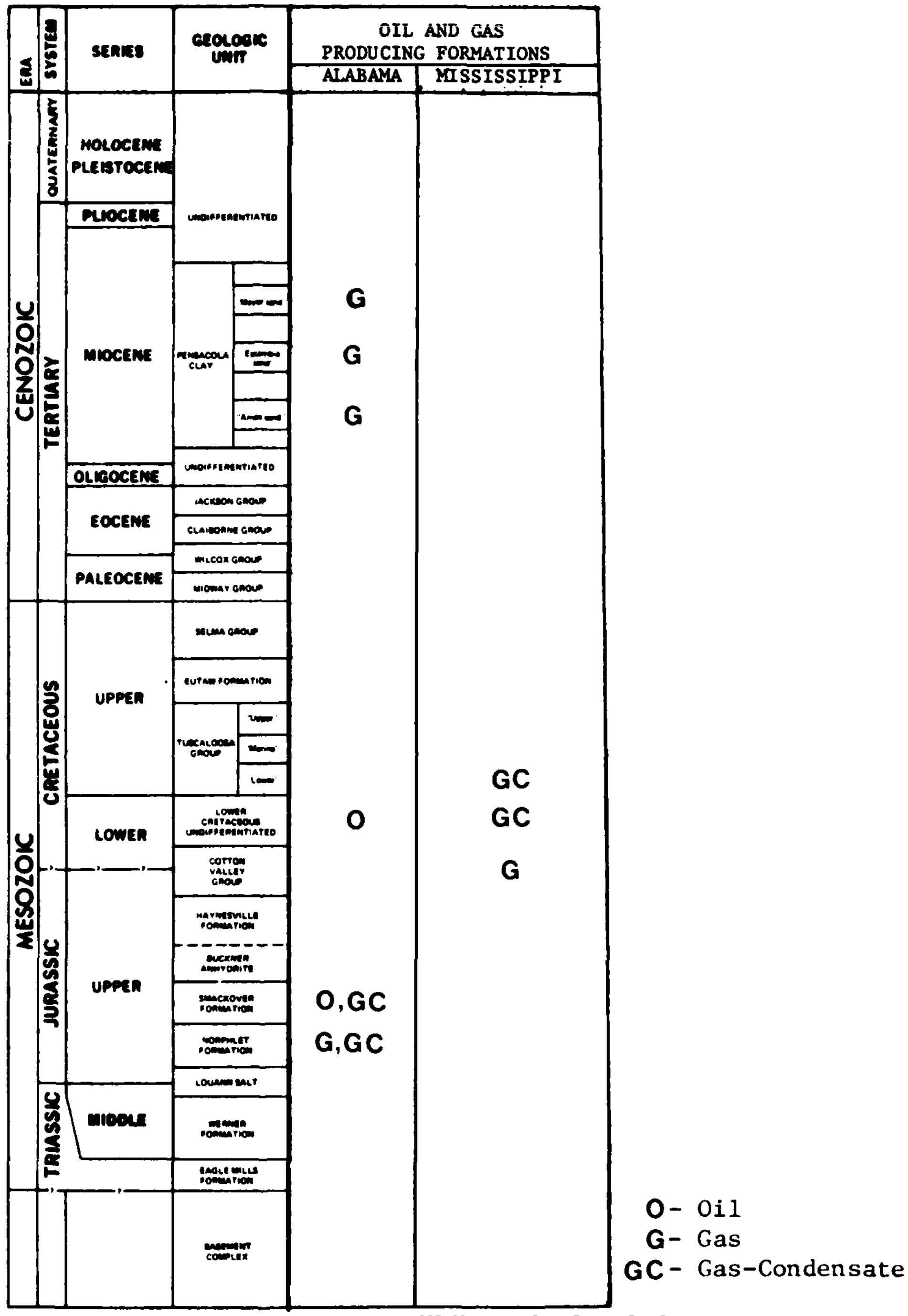
Barrier Islands

3.12 An important physiographic feature of the region is the group of offshore barrier islands and the Fort Morgan peninsula. This system is a major factor in determining the character of the region's coastal lands and waters (Marine Education Center, 1976; O'Neil and Mettee, 1982). These barrier islands absorb much of the high wave energy of the Gulf and, thereby, create a protected, lower-salinity habitat that is a critical feature of regional marine life. These islands also provide a certain measure of hurricane protection.

3.13 The wave energy of the south - southeastern waves of the Gulf create littoral currents that are constantly eroding the island faces and redepositing material toward the west. Erosion and redeposition has extended the western end of Dauphin Island about 4 miles in the last 100 years and has completely eroded the eastern half of Petit Bois Island. In fact, during the 1850's, the eastern end of this island was further east than the present western end of Dauphin Island. One recent major change in these islands occurred in 1969 when Hurricane Camille cut Ship Island into its present east and west sections. In 1979, Hurricane Frederic caused heavy erosion on Dauphin Island when the hurricane hit the coast with wind speeds of 145 miles per hour.

Stratigraphy

3.14 The surface geology of the coastal and offshore areas consist of a series of unconsolidated sand, sand and gravel, silt and clay deposits that dip southwestward (Gulf Regional Planning Commission, 1980; Dockery, 1981; O'Neil and Mettee, 1982). Under these sediments are a wide variety of geologic units, extending as much as 25,000 feet down to the basement complex of igneous and metamorphic rocks. In general, these sediments also dip southwestward at 10 to 50 feet per mile. For example, the Jurassic Smackover Formation (a major oil and gas producer) is at approximately 15,000 feet in northern Baldwin County and at approximately 20,000 feet in southern Mobile Bay. Figure 3-4 presents a generalized stratigraphic column for coastal Alabama and Mississippi.



Source: Bolin and Masinghill, 1983; Dockery, 1981; Luper, 1983; Mississippi State Oil and Gas Board, 1983

FIGURE 3-4
GENERALIZED STRATIGRAPHIC COLUMN OF OIL AND GAS PRODUCING AREAS OF COASTAL ALABAMA AND MISSISSIPPI

Non-Hydrocarbon Mineral Resources

3.15 The primary mineral resources of the region, other than oil and gas, are sand and gravel from alluvial, beach and terrace deposits (Nungesser et al., 1982; Gulf Regional Planning Commission, 1980; Beg, 1980). Scattered clay deposits occur in the Citronelle Formation in Baldwin County (Szabo and Clarke, 1969; Cook and Smith, 1982) and are mined to some extent. Oyster shells are mined hydraulically in large quantities from upper Mobile Bay and its tributaries, primarily for use in the manufacture of cement, with other uses including masonry block, poultry feed supplements, chemicals, and road or foundation materials. In 1979, Alabama was ranked third nationally in the production of oyster shell, with an annual production of about 1 to 1.5 million cubic yards (Friend et al., 1982; U.S. Army, Corps of Engineers, 1983b).

Hydrocarbon Resources

3.16 The most important mineral resources of the study area are the oil and gas produced in Mobile and Baldwin Counties, Alabama and Hancock County, Mississippi. Oil and gas production in the area started in 1950 in Alabama (the South Carlton Field in Baldwin County) and 1955 in Mississippi (the Ansley Field in Hancock County). By the end of 1983, there was active hydrocarbon production from 16 different fields in the two states and exploration and development was occurring in several areas (Bolin and Masingill, 1983; Mississippi State Oil and Gas Board, 1983; Mink, 1984). Table 3-1 presents a hydrocarbon production history for the study area and Figure 1-2 locates the producing fields and the new fields under development.

3.17 At present, development is focused on deep (18,000 to 22,000 feet) Upper Jurassic finds of oil and gas in the Mobile Delta (e.g. the Movico Field) and in Mobile Bay (e.g. the Lower Mobile Bay Field) with additional attention focused on shallow (1,300 to 1,800 feet) Miocene gas deposits in southern Baldwin and Mobile Counties (Bolin and Masingill, 1983; Mink, 1984). By the end of 1983, there were nine different Miocene gas fields established in Baldwin County, all discovered since 1979. Similar Miocene gas deposits have been found at five shallow wells (1,900 to 2,000 feet) in southern Mobile County (Mink, 1984) and a completion was made to a Miocene formation from one of the Lower Mobile Bay Field lease tracts. In Hancock County, the newest find is the Catahoula Creek Field, producing gas from the 20,000-foot deep Cotton Valley gas pool, an Upper Jurassic producer (Mississippi State Oil and Gas Board, 1983). Exploratory drilling and completion activities are presently (mid 1984) occurring in the Mobile Delta, Mobile Bay, and Mississippi Sound and the Alabama state waters of the Gulf of Mexico. In August 1984, an additional 19 tracts were leased in Alabama state waters. Figure 1-3 shows the location of presently leased areas in state waters and the active lease areas in federal waters adjacent to the study area.

TABLE 3-1

OIL AND GAS FIELDS PRODUCTION HISTORY IN COASTAL ALABAMA AND MISSISSIPPI

STATE AND COUNTY	FIELD NAME	DIS-COVERY DATE	APPROX. PRODUCING DEPTH (feet)	PRODUCING HORIZON	NUMBER OF WELLS	CUMULATIVE PRODUCTION[f] OIL (bbls)	CONDENSATE (bbls)	GAS (Mcf)
ALABAMA								
Baldwin County	Blacksher	1980	15,600	Smackover	3	601,030	0	640,262
	Foley	1979	1,660	Miocene	5	0	0	4,038,962
	Little River	1981	14,980	Smackover	1	110,121	0	127,331
	Pleasant View	1982	1,705	Miocene	2	0	0	636,948
	Skunk Bayou	1981	1,215	Miocene	1[a]	0	0	5,929
	S. Carlton	1950	5,425	Tuscaloosa	56	5,448,673	0	0
	S. Weeks Bay	1980	1,765	Miocene	1	0	0	939,680
	Tensaw Lake	1965	8,385	Lr. Cretaceous	b	164,786	0	0
	West Foley	1981	1,655	Miocene	6	0	0	3,265,583
Mobile County	Chunchula	1974	18,450	Smackover	34	0	25,772,773	64,674,752
	Citronelle	1955	10,500	Lr. Cretaceous	466[c]	178,876,273	0	12,515,591
	Cold Creek	1978	18,430	Smackover	2	431,443	0	428,914
	Hatter's Pond	1974	18,150	Smackover, Norphlet	14	0	18,459,280	71,880,186
	Movico	1982	16,910 16,950	Smackover	2	446,646	0	336,297
	S. Cold Creek	1975	18,450	Smackover	1	31,687	0	38,679
MISSISSIPPI								
Hancock County	Ansley	1955	10,800	Washita-Fredericksburg	d	535,004	e	13,671,491
		1981	9,500	Upper Tuscaloosa	1		24,408	439,380
	Catahoula Creek	1981	20,000	Cotton Valley	2	0		2,165,159
	Kiln	1959	10,285	Washita-Fredericksburg	d	107,957	e	22,226
	Waveland	1965	13,500	Mooringsport	23		1,627,309	97,835,158
			12,400	Paluxy	1	8,166	e	501,112
		1978	10,600	Washita-Fredericksburg	2	20,864	e	449,067

a-Abandoned in 1983, flow tested only.
b-Abandoned 1972.
c-Enhanced recovery wells included as producers.
d-Abandoned 1967.
e-Mississippi annual report does not list condensates separately.
f-Cumulative production: Mississippi through 1983, Alabama through June 1984.

Source: Luper, 1983, 1984; Mississippi State Oil and Gas Board, 1983; Bolin and Masingill, 1983; Mink, 1984.

Soils

3.18 The soils of the area have formed in the marine and alluvial sediments and organic residues of the tidal marshes, floodplains, upland flats and Coastal Plain uplands of the region (U.S. Department of Agriculture, Soil Conservation Service, 1964a, 1964b, 1975, 1980, 1981).

Soil Associations

3.19 The various soils of the region's counties are combined into soil associations, landscapes with a distinctive proportional pattern of specific soils, generally consisting of one or more major soils and at least one minor soil. The counties within the region are generally divided into 8 to 10 soil associations with a large number of individual soils. The number of individual soils identified and mapped range from 34 soils in Harrison County to 122 soils in Baldwin County (U.S. Department of Agriculture, 1964a, 1975). Although the various engineering properties and soil limitations of individual soils are important for the analysis of site specific developments, another soil classification is important on a county-wide or regional basis. This classification is the group of soils that are of major or potentially major significance to agriculture: the prime farm lands.

Prime Farmlands

3.20 Prime farmlands are those lands whose value derives from their general advantage as cropland due to soil and water conditions (Peterson, 1976). The benefits of such farmlands stem from their capacity to produce relatively more food with less erosion and with lower demands for fertilizer, energy, and other resources.

3.21 Within the study area, the particular soils that have been classified as prime farmland are generally fine sandy loams or sandy loams with slopes less than five percent (U.S. Department of Agriculture, Soil Conservation Service, 1964a, 1964b, 1975, 1980, 1981). The soils thus identified are prime farmland except where the use is urban land or builtup land, where the water table is not maintained at a sufficient depth, or where flooding is more often than once in two years during the growing season (U.S. Department of Agriculture, Soil Conservation Service, 1982).

3.22 For the five-county study area, there are approximately 890,000 acres of soils that are potentially prime farmland (Table 3-2) Because the prime farmlands are identified on the basis of specific soils and because these soils may cover relatively small geographic areas, it is not possible to include adequate maps of these areas in this study.

TABLE 3-2

PRIME FARMLAND SOILS IN THE STUDY REGION

County	Number of Soils	Acres (Approx.)	Percent Of County
Baldwin	61	307,000	29
Mobile	21	160,000	20
Jackson	19	159,000	33
Harrison	12	147,000	39
Hancock	14	116,000	37

Source: Alabama Prime Farmlands - Meetze, 1982.
Mississippi Prime Farmlands - Koos, 1983.
Acreage - U.S. Department of Agriculture, Soil Conservation Service, 1964a, 1964b, 1975, 1980, 1981.

Groundwater

3.23 The primary aquifers in the project area are the Miocene-Pliocene aquifer underlying the southernmost areas of Alabama and Mississippi, contiguous coastal waters and the alluvial aquifer adjacent to the Mobile River Delta and Mobile Bay and coastal Mississippi. The location of these aquifers is shown in Figure 3-5.

Alabama Aquifers

3.24 The Miocene-Pliocene aquifer underlies the entire area covered by Baldwin and Mobile Counties, Alabama. The static water level or pressure surface of this aquifer ranges from 50 to 100 feet below ground surface (Alabama Coastal Area Board, 1980). The bottom or base of fresh water (defined as water with less than 10,000 milligrams per liter total dissolved solids) ranges from 1000 to 2000 feet below mean sea level (Epsman et al., 1983). This level represents the base of protected groundwater.

3.25 The alluvial aquifer consists of Quaternary-age channel and flood plain deposits. These deposits are beds of sand and gravel generally surrounded by silty and clayey material. This aquifer is relatively thin, extending from the ground surface to about 150 feet and water quality is highly influenced by surface factors. Both the Miocene-Pliocene aquifer and alluvial aquifer outcrop in the project area. Recharge to both aquifers is effected through direct infiltration from rainfall and periodic freshwater inundation. The recharge area coincides generally with land areas overlying the the aquifers shown on Figure 3-5.

3.26 Water Quality. The quality of water in the Miocene-Pliocene aquifer is generally good. Wells drilled into this aquifer yield water that is usually soft and with a dissolved solids concentration of less than 200 mg/l. Iron concentrations in excess of 0.3 mg/l can be found throughout the aquifer (Riccio et al., 1973). The water quality of the alluvial aquifer is good--generally soft and with dissolved solids concentrations much less than 100 mg/l. Additionally, iron concentrations may exceed 0.3 mg/l. In areas near Mobile Bay, Mississippi Sound and the Gulf, the water contains iron in excess of 0.3 mg/l, chlorides in excess of 250 mg/l and dissolved solids in excess of 1,000 mg/l.

3.27 Water Use. The groundwater in the project area is used for public water supplies and domestic uses as well as for irrigation and industrial purposes. Table 3-3 lists water use in Baldwin and Mobile Counties from surface and groundwater sources. Groundwater supplied about 90 percent of the total use during 1981

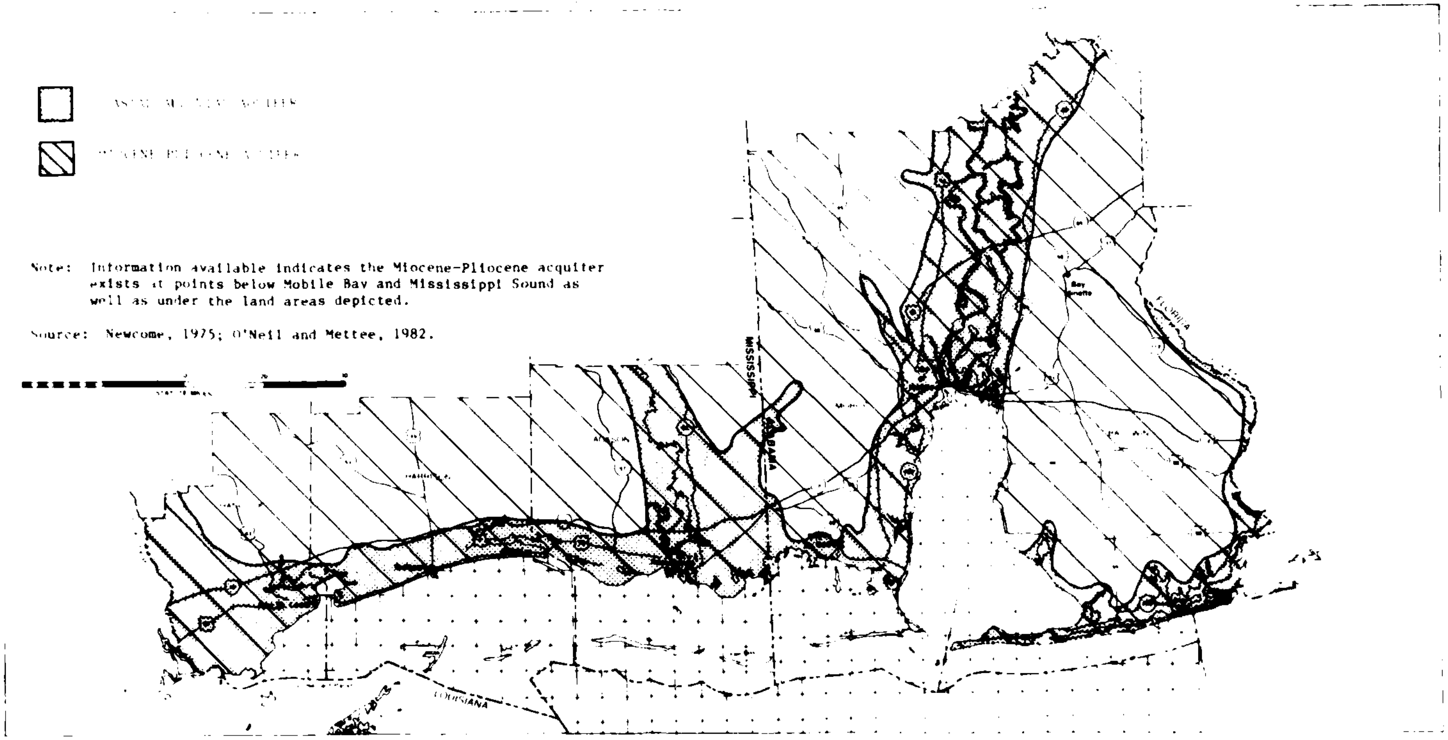


FIGURE 3-5
AQUIFERS OF COASTAL ALABAMA AND MISSISSIPPI

TABLE 3-3

SUMMARY OF WATER USE IN BALDWIN AND MOBILE COUNTIES, ALABAMA (MILLION GALLONS PER DAY)

	Baldwin County				Mobile County			
	Groundwater		Surface Water		Groundwater		Surface water	
	1966[a]	1981[b]	1966[a]	1981[b]	1967[c]	1981[b]	1967[c]	1981[b]
Public water supply	2.0	6.6	0	0	6	5.4	25	128.7
Rural use[d]	3.6	5.8	0	0.8	3	2.3	2	1.1
Self-supplied industries	1.5	0.04	0	0.59	32	25.9	778[e]	79.6
Thermoelectric								976.1

[a]Source: Reed and McCain, 1971.

[b]Source: Baker and Moore, 1983.

[c]Source: Reed and McCain, 1972.

[d]Includes agricultural and self-supplied domestic for 1981.

[e]Includes thermoelectric water use.

in Baldwin County but only 3 percent in Mobile County. Public water supply from groundwater has decreased for Mobile County since 1967 and increased for Baldwin County. Salt water could intrude into the aquifer in Mobile, Dauphin Island and Gulf Shores, as more water is pumped from the aquifers adjacent to salt water and the fresh water levels decline. Increasing chlorides have been experienced in wells north of Mobile and along the Mobile River.

3.28 Deep-Well Injection. Deep-well disposal of waste water has been practiced in Alabama since 1950. The early deep-well injection systems disposed of oil field brines. Salt water disposal wells from the oil and gas industry are designated as Class II disposal wells, as are injection wells for enhanced recovery and for storage of hydrocarbons. Alabama statewide has well over 100 injection and enhanced recovery wells. No failures causing groundwater contamination have been severe enough to cause abandonment and plugging of injection wells (Alabama State Oil and Gas Board, 1981). Successful injection of oil field brines has been practiced at the Citronelle Oil Field in northern Mobile County for over 30 years (Powell et al., 1973). Injection of produced brine takes place at two levels--the Upper Cretaceous formation at 7,000 feet below mean sea level and the Wilcox sand of Eocene age at a depth of 2,000 feet (Tucker and Kidd, 1973). In the same vicinity as the oil field, the City of Citronelle obtains its fresh water supply from the Miocene-Pliocene aquifer at a depth of 600 to 800 feet. Chloride content is generally low (less than 13 mg/l) at the Citronelle well and is apparently unaffected by brine disposal within the region (O'Neil and Mettee, 1982). In past years there have been injections of industrial wastes in Alabama coastal counties (Tucker and Kidd, 1973). Such wells are designated Class I and those presently existing are to be phased out over a period of years with no new Class I wells to be permitted. The locations of Class I and Class II wells in the project area are shown on Figure 3-6.

Mississippi Aquifers

3.29 In coastal Mississippi the Miocene-Pliocene aquifer is composed of a surficial aquifer called the Citronelle aquifer and several deeper aquifers (the Graham Ferry and Pascagoula) which are collectively described as the Miocene aquifer. The base of fresh water (total dissolved solids less than 10,000 milligrams per liter) ranges from about 1600 to 3600 feet below mean sea level.

3.30 Where the Miocene aquifer outcrops in the counties north of the project area, recharge is directly from rainfall. Where the Miocene is overlain by the Citronelle, it is recharged by water moving through the quartz and gravel of the Citronelle. In some places the Miocene aquifers are confined by clay layers and artesian pressure develops in the aquifer.

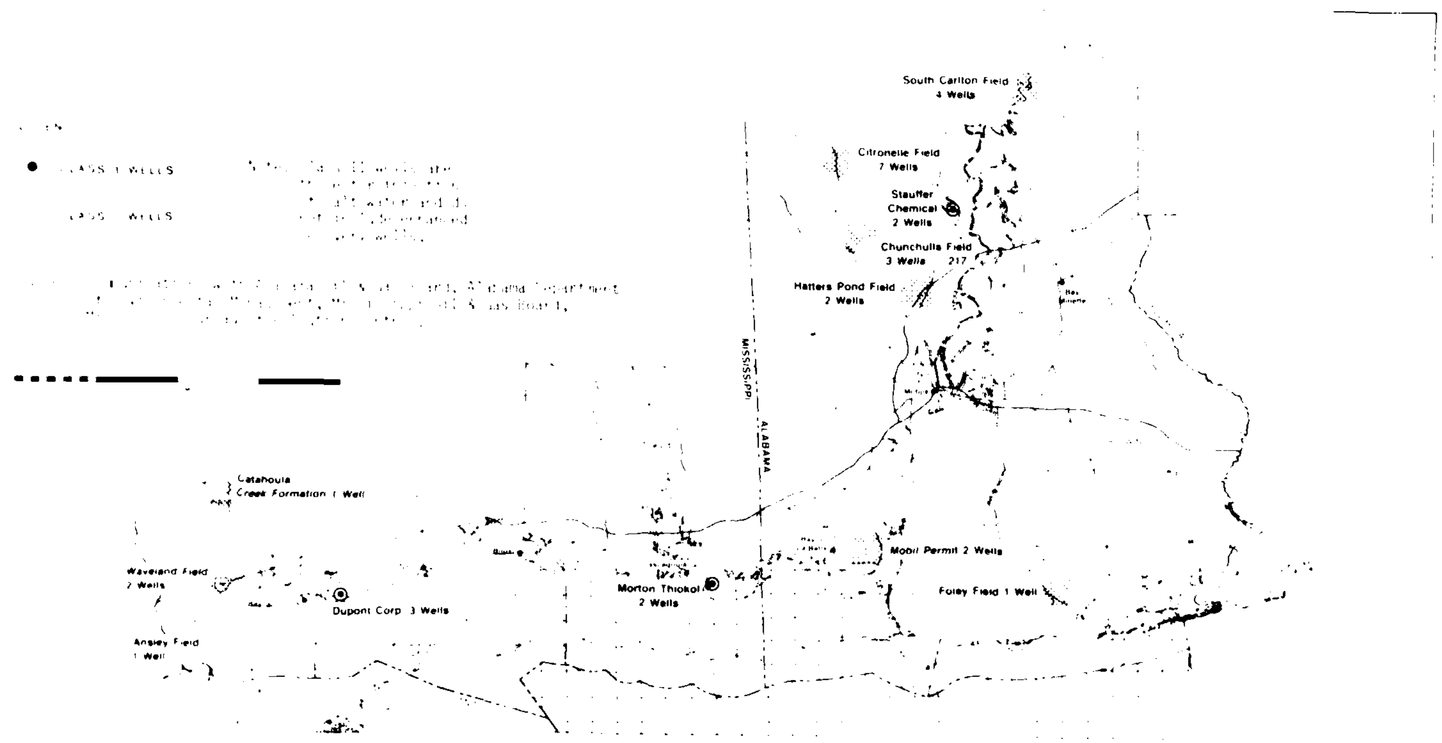


FIGURE 3-6
LOCATION OF CLASS I AND CLASS II DISPOSAL WELLS

3.31 Water Quality. The Citronelle aquifer is generally low in total dissolved solids except in places along the coast where seawater is in contact with the aquifer. At many locations the water is high in iron content. The preferred aquifer for drinking water purposes is the Miocene aquifer. The water in the Miocene wells less than 200 feet deep commonly has dissolved solids concentrations of less than 100 mg/l (Wasson, 1980).

3.32 Water Use. Groundwater in the coastal Mississippi counties is the only source of public water supplies. Table 3-4 lists the 1975 and 1980 groundwater and surface water use in the project area. Harrison County had the largest groundwater usage, nearly 26 million gallons per day, in 1980.

3.33 Considerable artesian pressure existed in the coastal counties of Mississippi prior to 1900 with the pressure surface being 65 to 70 feet above ground level (Wasson, 1978; Newcome et al., 1968). As the groundwater resources have been developed in the coastal area the pressure surface has declined to less than mean sea level in areas of heavy pumpage and to near ground level in other areas along the coast. The areas of biggest declines in water level are Biloxi, Gulfport and Pascagoula. Areas of heavy pumpage and deep cones of depression may exhibit increased levels of dissolved solids (Wasson, 1980).

3.34 Deep-Well Injection. Wells for discharge of oil field salt brines (Class II wells) have been in use in Mississippi since 1942. Nearly 1500 Class II wells exist throughout the state at present (Mississippi State Oil and Gas Board, 1982a). Contamination of freshwater aquifers, possibly from brine infection, has been experienced in some areas of Mississippi (Mississippi Department of Natural Resources, 1982a). Locations of areas with Class I and Class II injection wells in coastal Alabama and Mississippi is shown on Figure 3-6.

Regulatory Programs

3.35 The following sections outline the state regulatory programs relating to groundwater protection.

3.36 Alabama. The State of Alabama protects the groundwater resources through the State Oil and Gas Board and the Alabama Department of Environmental Management. The Oil and Gas Board regulates the drilling and operation of wells used for exploration and production of hydrocarbons and the disposal of brines by underground injection, the injection of fluids for enhanced recovery (Class II wells as defined by Alabama State Oil and Gas Board, 1981). The Department of Environmental Management regulates the drilling and operation of underground wells for disposal of industrial wastes (Class I and Class IV wells), new applications for

TABLE 3-4

SUMMARY OF WATER USE IN COASTAL MISSISSIPPI COUNTIES
(MILLION GALLONS PER DAY)

	Groundwater		Surface Water	
	1975	1980	1975	1980
Jackson County				
Public supplies	8.9	10.5	0.000	0.000
Rural	0.6	1.4	0.036	0.025
Self-supplied industry	10.6	10.1	42.35[a]	56.10[a]
Total	20.1	22.0	42.4	56.1
Harrison County				
Public supplies	17.1	19.2	0.000	0.000
Rural	2.6	1.6	0.060	0.037
Self-supplied industry	5.7	5.0	0.000	0.000
Total	25.4	25.8	0.06	0.04
Hancock County				
Public supplies	1.56	1.59	0.000	0.000
Rural	0.31	0.59	0.057	0.037
Self-supplied industry	2.31	2.58	0.000	0.000
Total	4.2	4.8	0.06	0.04

[a] Including water for thermoelectric power.

Source: Callahan, 1982.

which will no longer be approved. Regulations which explicitly or implicitly protect fresh groundwater sources during the drilling and operation of hydrocarbon wells are listed in Table 3-5.

3.37 Mississippi. In Mississippi the hydrocarbon industry is regulated by the State Oil and Gas Board. The underground injection control program is administered by the State Oil and Gas Board for Class II wells and by the Bureau of Pollution Control within the Department of Natural Resources for Class I, III, IV, and V wells (Mississippi State Oil and Gas Board, 1982a). Future Class I, III and IV wells in Mississippi are prohibited. Table 3-6 summarizes the rules and regulations which explicitly or implicitly protect the groundwater resource from contamination by hydrocarbon development.

Air Quality

3.38 Regional air quality results from the interaction of climatic conditions and area pollutant emissions. The following sections present a summary of air quality and air quality standards for the project area. Local meteorology is given in the Climate section.

Dispersion Climatology

3.39 Certain climatic factors are predominant elements in the movement of air pollutants and in the resultant air quality character of the region. These factors include atmospheric stability and the coastal phenomenon of land breeze/sea breeze atmospheric circulation.

3.40 Atmospheric Stability. The frequency of various wind directional Pasquill Stability classes is presented in Table 3-7. Essentially, the data indicate that the greatest percentage of air flow is from the north or south. There is a surprisingly large frequency of Pasquill F stability, which is associated with light winds, clear skies, and nighttime inversion conditions (National Climatic Center, 1979). Apparently many of these inversions must be reasonably shallow, however, since Holzworth (1972) cites the fact that fewer than 20 days of subsidence inversions will occur in any 5-year period. Holzworth's study showed less than one percent of the inversions were deep in the project.

3.41 Influence of Sea/Land Breeze in the Coastal Area. Both sea breeze and land breeze circulations contribute to the ventilation and dispersion of source emissions. Sea breezes along the coast affect Mobile Bay in the summer season. These breezes are created by localized temperature and density gradients which are

TABLE 3-5

ALABAMA REGULATORY PROVISIONS TO PROTECT GROUNDWATER RESOURCES DURING HYDROCARBON DEVELOPMENT

Agency	Activity	Provisions	Mechanism of groundwater protection
Alabama Oil and Gas Board	Permitting	Rule 400-1-2-.01. Requires permits to drill exploratory wells, production wells or brine disposal wells.	Prevents indiscriminate drilling of wells through water bearing formations.
	Casing	Rule 400-1-3-.03. Prescribes minimum depth for surface casing and cement. See Table 1-7. Requires production string of casing to be cemented at least 500 ft above the top of the producing interval.	Proper casing and cementing of well prevents the entry of formation waters into the well and prevents entry of hydrocarbon into intermediate formations.
	Protection of fresh water	Rule 400-1-3-.04. Requires fresh waters be confined to respective strata. Special precaution in drilling and abandoning a well to guard against loss of artesian water and contamination of fresh water.	
	Plugging of well	Rule 400-1-3-.05 thru .07. Prescribes plugging methods of various lengths of concrete plugs.	Guards against loss of artesian water in abandoned well. Prevents contamination of fresh water strata by liquids from lower strata.
	Well record	Rule 400-1-2-.10. Requires accurate reporting of well drilling activity, strata encountered, casing records, etc.	Enables determination of depth of fresh water strata and steps taken to protect resource.
	Drilling fluid	Rule 400-1-3-.12. Requires continuous maintenance of drilling fluid in the hold to control any pressures encountered.	Hydrostatic pressure of drilling fluid during drilling operations prevents loss of fresh water under artesian pressure.
	Underground injection control	Rule 400-1-5-.04. Regulates underground disposal of brine fluids. Prohibits any underground disposal which may result in pollution of underground sources of drinking water. Wells must be cased and cemented to prevent loss of injected fluids into any strata not approved by the state.	Regulates Class II wells.
	Casing of offshore wells	Rule 400-3-X-.02. Specific minimum and maximum length of conductor and surface casing. See Table 1-8.	
	Disposal from offshore wells	Rules 400-3-X-.03 and 400-3-X.-4. Requires disposal of all produced waste water by injection or transporting to approved onshore facility.	
Alabama Dept. of Environmental Management	Underground injection of wastes	Chapter 9 of Water Quality Regulations 9.4.1 requires permit to inject any pollutant into any subsurface location. 9.4.2 prohibits introduction of pollutant in an underground drinking water source.	Regulates all underground disposal wells with the exception of Class II wells.
		9.4.2.(B)(1). Permitting of new Class I disposal wells prohibited.	Underground disposal of industrial wastes prohibited.
		9.4.2.(D)(1). Construction or operation of a Class IV well prohibited.	Underground disposal of hazardous wastes prohibited.
	Construction of disposal well	9.9 Construction requirements assure protection of underground drinking water sources	
	Operation of disposal well	9.7 and 9.8.2 issuance procedures. Requires determination of operation procedures to protect underground drinking water sources.	

MISSISSIPPI REGULATORY PROVISIONS TO PROTECT GROUNDWATER RESOURCES DURING HYDROCARBON DEVELOPMENT

Agency	Activity	Provisions	Mechanism of groundwater protection
Mississippi Oil and Gas Board	Permitting	Rule 4. Prior to drilling of any well in search of oil and gas or for the disposal of salt water, a permit application must be filed.	Prevents indiscriminate drilling of wells through fresh water formations.
	Sealing off strata	Rule 10. No stratum can be penetrated without use of mud-laden fluid. All water-bearing strata must be sealed.	Hydrostatic pressure of drilling fluid prevents loss of water under artesian pressure. Sealing of water-bearing strata prevents entrance of water into well or other strata and prevents contamination of water-bearing formations from oil and gas or formation fluids from other strata.
	Surface casing	Rule 11. Specific minimum amount of surface or first-intermediate casing. See Table 1-10.	Proper casing and cementing of well seals off water-bearing formations.
	Completion of well	Rule 23. Requires report specifying casing record, cement, etc.	
	Plugging well	Rules 27 and 28. Requires application to plug a well and sets forth plugging procedure to protect fresh water formations from contamination or loss of water.	Guards against loss of artesian pressure from an abandoned well.
	Injection of waste	Rule 45. Application for permit requires certification that the proposed injection zone is non-productive of oil or fresh water and that injection of salt water into said zone will not be detrimental to any oil or fresh water-bearing sands in the field.	Regulates drilling and operation of disposal wells.
	Prohibition of waste disposal by pollution of fresh water	Rule 63. Phases out use of earthern pits for waste disposal except as specifically allowed by the supervisor. Temporary salt water storage pits require impervious liner.	
	Disposal by injection	Rule 63.G. Requires casing and cementing according to Rules 11 and 12.	Regulates Class II wells
	Casing of offshore wells	Rule 05-4.B. Specific minimum and maximum casing requirements for conductor and surface casing. See Table 1-11.	
	Disposal from offshore wells	Rule 05-9.2.A.(5). Disposal of all produced waste water by injecting into approved subsurface formation or by transporting to approved onshore facilities.	
Bureau of Pollution Control, Miss. Dept. of Natural Resources	Underground injection of wastes	Sections 1 through 32. Underground injection control program regulations.	Regulates all underground disposal wells with the exception of Class II wells.
		Section 3. Permit Board to protect all underground sources of drinking water.	
		Section 6.(3). Requires permit for drilling of all underground disposal wells.	
		Section 15. Injection of any contaminant into underground source of drinking water is prohibited if the presence of the contaminant may cause a violation of any primary drinking water regulation.	
		Section 23. Regulations apply to any class of well injecting hazardous wastes.	
		Section 25. Sets forth construction requirements of Class 1 wells. Casing must prevent movement of fluids into or between underground sources of drinking water.	

TABLE 3-7

PASQUILL CLASS FREQUENCY IN MOBILE, ALABAMA FOR
1974 through 1978

Direction	Pasquill Class A	B	C	D	E	F	Average Wind Speed (knots)	Frequency (percent)
N	9[a]	115	178	301	356	450	8.3	10
NNE	6	71	90	120	175	290	7.1	6
NE	14	72	133	160	156	502	6.2	8
ENE	5	79	105	123	113	340	6.1	6
E	4	93	147	169	196	292	6.6	7
ESE	6	61	105	153	167	189	7.4	5
SE	8	69	137	280	300	290	8.1	8
SSE	5	50	78	183	216	263	7.7	6
S	11	80	159	403	374	553	8.2	11
SSW	3	40	74	159	149	239	7.9	5
SW	4	39	62	164	129	222	7.9	5
WSW	7	47	60	96	63	232	6.3	4
W	12	72	104	124	70	318	5.8	5
WNW	5	45	63	81	56	163	6.7	3
NW	5	79	120	201	127	332	7.5	6
NNW	4	56	89	152	140	242	8.2	5
Calm	17	10	73	6	49	992		
Overall average speed							6.8	
Frequency (percent)	1	7	12	20	19	40		

A-Extremely unstable conditions.
B-Moderately unstable conditions.
C-Slightly unstable conditions.
D-Neutral conditions.
E-Slightly stable conditions.
F-Moderately stable conditions.
[a] Presented in 3-hourly occurrences.

established along the coastline. The cooler sea air is denser and sinks, while the hotter land air rises. Surface air flow will then move from the sea to the land, whereas at some greater height (1,500 to 2,000 ft) the flow will be opposite. At night this flow is reversed due to the fact that the land cools more rapidly than the sea, and flow at the surface level is toward the sea. While these breezes offer the cleansing effect of ventilation and dilution of pollutant material, they can also cause recirculation of the air toward its point of emission.

Air Quality Standards

3.42 Information on air quality standards is presented for the two states of the project area (Alabama and Mississippi) and for the two states adjacent to the project area (Florida and Louisiana). The adjacent states are included since atmospheric dispersion mechanisms could transport project-generated pollutants into these areas.

3.43 Alabama. Alabama has accepted federal ambient air quality standards (see Table 3-8) and the bubble concept is endorsed in the state. The state has full Prevention of Significant Deterioration (PSD) authority and has permitted oil well rigs under PSD authority.

3.44 Mississippi. Mississippi has accepted federal ambient air quality standards. It also has developed explicit odor regulations which may affect near-shore drilling and/or associated operations. The state has PSD authority and has permitted hydrocarbon activities. In so doing however, most of the long-term PSD Class I increment for SO_2 was consumed on the Louisiana State Breton Wildlife Refuge area. This increment consumption was due in part to oil tanker operations attendant to the facility. However, the PSD review of this situation has been challenged. The PSD Class II increment is nearly consumed in the area near the coast, south of the Chevron refinery at Pascagoula. While tanker emissions produced the critical PSD impacts, the SO_2 impact from refinery point sources is substantial.

3.45 Louisiana. Louisiana has accepted federal ambient air quality standards and the bubble concept for air permitting is endorsed in the state. Louisiana has full PSD authority.

3.46 Florida. Florida has accepted federal ambient air quality standards for carbon monoxide, hydrocarbons, and oxides of nitrogen. Florida has more rigorous standards than the federal regulations require for both particulates and sulfur dioxide. Florida mandates compliance with the federal primary standard for

TABLE 3-8

FEDERAL PRIMARY AND SECONDARY AIR QUALITY STANDARDS

Pollutant	Averaging Time	Federal Primary Standard	Federal Secondary Standard
Nitrogen dioxide[b]	Annual average	0.05 ppm[a] (100 ug/m^3)	0.05 ppm[a] (100 ug/m^3)
Sulfur dioxide	Annual average	0.03 ppm (80 ug/m^3)	-
	24 hour	0.14 ppm (365 ug/m^3)	-
	3 hour[c]	-	0.50 ppm (1300 ug/m^3)
Suspended particulates	Annual geometric mean	75 ug/m^3	60 ug/m^3
	24 hour	260 ug/m^3	150 ug/m^3
Photo-chemical oxidants	1 hour	0.120 ppm (235 ug/m^3)	0.120 ppm (235 ug/m^3)
Carbon monoxide	8 hour	9 ppm (10 mg/m^3)	9 ppm (10 mg/m^3
	1 hour	35 ppm (40 mg/m^3)	35 ppm (40 mg/m^3)

All standards except annual average are not to be exceeded more than once a year.

[a]ppm = parts per million
ug/m^3 = micrograms per cubic meter
mg/m^3 = milligrams per cubic meter

[b]Nitrogen dioxide is the only one of the nitrogen oxides considered in the ambient standards.

[c]Maximum 3-hour concentration between 6-9 am.

Source: Bureau of National Affairs, 1973 (as amended through July, 1983).

TSP at 260 ugm/m^3 (no secondary standard is permitted). The Florida standard for 24-hour sulfur dioxide concentrations is 260 ugm/m^3 as compared with the federal standard for the same time period of 365 ugm/m^3. These stricter pollutant limits could well have a bearing on future hydrocarbon development in and near the Florida region. Florida has full PSD authority.

Project Area Emissions

3.47 Stationary Sources. Total emissions for Mobile, Baldwin and Escambia Counties, Alabama (typical of the Mobile Bay Area) for 1973 and 1977 are listed in Table 3-9. There was a reduction in total emissions during this period for particulates, sulfur oxides, nitrogen oxides, and hydrocarbons. Carbon monoxide increased during this period. The reductions have been 25 percent for particulates, 58 percent for sulfur oxides, 28 percent for oxides of nitrogen and six percent for hydrocarbons; for carbon monoxide there was a 19 percent increase in the area. Since 1977, however, carbon monoxide concentrations have dropped about 10 percent. Reductions of particulates, sulfur oxides, oxides of nitrogen, and hydrocarbons, all evidenced by decreased ambient concentration levels as previously noted, also indicated that emission capture is ranging from 25 to 50 percent greater in 1980 than it was in 1975.

3.48 The remainder of the project area has less emissions and greater reduction in total emissions than Mobile and surrounding areas. The only possible exception would be found in the extreme western portion of the project area.

3.49 Non-Stationary Sources. The Alabama Highway Department (1974) has conducted an analysis of emission trends for the period from 1974 until 1990. The original study indicated a reduction of 65 percent in CO, 55 percent in THC, and 20 percent in oxides of nitrogen. A subsequent revision of this study has shown an even greater decrease in vehicular emissions in the Mobile area.

Ambient Concentration Data

3.50 Alabama. In the 1970s, air quality in coastal Alabama, particularly in Mobile, was monitored by the Alabama Air Pollution Control Commission. Particulate matter has exceeded the primary standard on 10 occasions since 1972. The secondary standard has been exceeded 140 times since 1972 (O'Neil and Mettee, 1982).

3.51 Since 1976 sulphur dioxide levels in Mobile have slightly exceeded 3-hour air quality standards on only one occasion (1978). High nitrogen oxides levels have been measured in Mobile but they did not exceed the annual standard of 0.05 ppm. Carbon

TABLE 3-9

TOTAL EMISSIONS IN MOBILE, BALDWIN AND ESCAMBIA COUNTIES, ALABAMA FOR 1973 AND 1977

Year And Category	Pollutant (tons)				
	Particulates	Sulfur Oxides	Nitrogen Oxides	Hydrocarbons	Carbon Monoxide
1973					
Point source	40,076	220,651	55,991	20,074	17,429
Area source	8,403	3,707	22,161	36,029	179,140
TOTAL	48,479	224,358	78,152	56,103	196,569
1977					
Point source	13,773	79,452	31,308	5,392	16,349
Area source	22,885	14,839	25,232	47,742	218,477
TOTAL	36,658	94,291	56,540	53,104	234,826

Source: Mobil Oil Exploration and Producing Southeast, Inc., 1981b.

monoxide readings in central Mobile during 1978 and 1979 exceeded the federal 8-hour standard. Ozone standards were exceeded on four occasions in 1977 and 1978 at different sampling stations.

3.52 Mississippi. The state was in compliance with TSP standards in 1982. The only CO Monitor (Jackson) indicated no exceedance of standards. The state is designated unclassifiable for CO. The entire state is in compliance in regard to sulfur dioxide. The state is also in compliance with regard to lead and nitrogen oxide. Only one station, Hernando, in DeSoto county recorded a single ozone excess of standard in 1982.

3.53 Louisiana. The State of Louisiana is in compliance for all pollutants with the exception of ozone. The state has embraced the official EPA-recommended vapor recovery rules and hydrocarbon emissions limitations designed to control volatile organic compounds, the primary sources of ozone. Louisiana possesses a Class I area in the Breton National Wildlife Refuge area located some 25 miles south of Biloxi, Mississippi. A hydrocarbon processing facility with a Mississippi PSD permit has consumed a portion of the sulfur dioxide increment available making it possible that other PSD applicants may have to use offsets to successfully permit operations in this area. Louisiana is now invoking an odor standard. This will be the first state in the Southeast to specify a measurable comparative odor strength technique using butanol. The Louisiana odor standard is patterned after one developed in San Francisco, California.

3.54 Florida. The numerous violations of ambient air quality standards in the past several years have all occurred in the vicinity of major cities, well away from the project area under consideration.

Air Quality Non-Attainment

3.55 Alabama has a non-attainment area in Mobile County for ozone. A conference with state personnel (Gore, 1983, personal communication) indicates that this condition may now be improved but total evidence that it has reached attainment is not yet available. The dock areas in Mobile County are also in non-attainment for TSP. The coastal areas of Mississippi are considered in attainment. Louisiana has an ozone non-attainment area at New Orleans, west of the study area, and Florida has no non-attainment area near the projected development areas. PSD increments are available in all areas within the project area except in the immediate Mobile area.

Trends in Air Quality and Analysis

3.56 In general, air quality has shown considerable improvement over this area. The greatest amount of improvement still needed in relation to the proposed project, however, is in the Mobile, Alabama area. Other nearby areas have shown reductions of from 25 to 50 percent in concentrations of pollutants. This is mainly evident from ambient monitoring records. Some isolated locations appear to have some limited problems with particulates. Almost the entire area still experiences an ozone problem which is not likely to be resolved in the foreseeable future. It is possible that the Breton National Wildlife Refuge area may restrict significant expansion along the western portion of the project area since PSD increments are quite small for a Class I area and evidence is available that a portion of the long-term sulfur dioxide increment has already been committed.

Noise

3.57 The following discussion of environmental noise is divided into two parts. The first section is an overview of noise regulations. The second part consists of a discussion on ambient noise levels along coastal Alabama and Mississippi. Details of methods used to measure sound energy and noise terminology are given in Appendix E.

Noise Regulations

3.58 Federal regulations relating to noise production include the Noise Control Act of 1972 (42 USC 4901), the Quiet Communities Act of 1978 (42 USC 6901, 40 CFR 201; WAPORA, 1981), the Occupational Safety and Health Act (OSHA) of 1970 (U.S. Army Corps of Engineers, Mobile, 1980), and the Walsh-Healy Act (U.S. Environmental Protection Agency, Region IV, 1978). Additional standards are listed in 40 CFR 201, 41 FR 2184, and 39 FR 38215 (New England River Basin Commission, 1976). Other noise guidelines and standards have been recommended by EPA, HUD, other federal agencies, and individual state and municipal governments.

3.59 Although state and city governments may also control noise levels, they may not pass regulations that conflict with federal laws. Within the study region, Alabama and Mississippi generally consider noise issues during environmental permitting if identified during public review. In Mississippi, the Bureau of Pollution Control and the Permit Board may become involved, but no state statutes or regulations for environmental noise mitigation have been adopted (WAPORA, 1981). Alabama has no permit conditions governing noise levels (WAPORA, 1981) and has proclaimed state noise regulations only for watercraft (U.S. Army Corps of Engineers, 1980).

Ambient Noise Levels in the Alabama/Mississippi Study Region

3.60 The approximate distribution of noise producers associated with industrial and commercial areas in coastal Alabama is concentrated in Mobile County north of downtown Mobile along the riverfront, the Theodore area south of the City of Mobile, the Mobile River north of the Mobile urban area, and the Bucks area along the western bank of the Mobile River north of Satsuma (Friend, et al., 1982). The coastal industrial and/or commercial areas in the Mississippi portion of the project area are primarily located in the Pascagoula, Biloxi, Gulfport, and Bay St. Louis areas. Pascagoula is the most industrialized city of coastal Mississippi. Ambient noise levels within the project area provide necessary baselines for industrial or commercial noise impact evaluation and development planning. Measurements published in 1974 of ambient noise on Dauphin Island are contained in Table 3-10. Also in Table 3-10 are 1977 ambient levels for the Theodore Industrial area and 1980 noise data for the area around Mobil Oil's proposed gas plant in southern Mobile county. By comparing the area specific recordings to the typical noise levels expressed in Table 3-11, it can be seen that the typical levels for a noisy urban setting (66 L_{dn}) are similar to the highest L_{dn} level (67 L_{dn}) recorded in 1977 for the Theodore industrial area. The measurements taken on Dauphin Island illustrate the influence of natural environmental conditions on noise levels. On the eastern point of the island, near shore, with 8 to 10 mile-per-hour winds and light waves breaking, 55-65 dBA were recorded. On the southern shore of the islands near a commercial business with breaking surf 74 - 76 dBA were measured.

3.61 Expected noise levels along residential, commercial, industrial and resort areas of the Mississippi coast would be similar to sample ambient levels recorded in a variety of locations in coastal Alabama. Wildlife is also affected by noise. Wildlife sensitive receptor areas are wetlands, forests, old fields, and generally undeveloped land. Such receptor sites cover a large percentage of the project area, particularly in the Mobile River Delta.

SUBREGIONAL PHYSICAL AND BIOLOGICAL CHARACTERISTICS

3.62 The study area consists of four relatively distinct environments:

- o Mobile Delta
- o Mobile Bay
- o Mississippi Sound
- o State waters of the Gulf of Mexico

TABLE 3-10

AMBIENT NOISE LEVELS WITHIN THE ALABAMA PORTION OF THE STUDY AREA

Location/Condition/Year	Time (Hours)	Noise Level (dBA) dBA	L50	L90	Ldn	Leq(24)[b]
East point Dauphin Island, near shore, 8-10mph SW winds, light waves breaking - 1974	1600	55-65[a]				
East point Dauphin Island, 80-100 ft. from shoreline 8-10mph SW winds, light waves breaking - 1974	NA	52-58[a]				
South Shore Dauphin Island, surf breaking near Holiday Inn - 1974	1945	74-76[a]				
Theodore Industrial Area, 1977						
Station 1					55	48/70
Station 2					54	49/70
Station 3					48	45/70
Station 4					72	66/70
Station 5					48/55	45
Station 6					65	61/55
Station 7					55	53/55
Station 8					55/55	48
Station 9					53/55	51
Station 10					54/55	52
Station 11					67	59/70
Station 12					67/55	66
Mobile Area, east of Dauphin Island, Pkwy. on Bellingrath Rd. near Mobil Oil proposed gas plant site - 1980[c]						
Site 3	0700-1200		41	38		
Site 3	1200-1800		45	39		
Site 3	1800-2200		33	32		
Site 3	2200-0700		45	41		
Site 3	24 hours				56.7	
Site 4	0700-1200		40	38		
Site 4	1200-1800		41	37		
Site 4	1800-2200		43	42		
Site 4	2200-0700		45	42		
Site 4	24 hours				52.7	

[a]Measurements represent one point in time and do not account for changing sound levels over time.

[b]Second numbers refer to source levels requisite to protect public health and welfare according to land use.

[c]L_{90} and L_{50} values based on 20 minute sample during each period.

Sources: Coastal Ecosystems Management Inc. 1974; U.S. Army Corps of Engineers 1980, 1982a; U.S. Environmental Protection Agency, Region IV 1978.

TABLE 3-11

TYPICAL NOISE LEVELS FOR VARIOUS DETACHED RESIDENTIAL DEVELOPMENT AREAS

Type of Residential Area	Typical Noise Levels (dBA) Daytime L90	L50	Day - Night Ldn
Rural Residential	--	--	39
Wooded Residential	--	--	51
Quiet Suburban Residential	38	43	--
Normal Suburban Residential	43	48	--
Urban Residential	48	53	58
Noisy Urban Residential	53	58	66

Source: U.S. Environmental Protection Agency 1971, 1978.

In the following sections the physical and biological characteristics of these four regions are summarized.

Mobile Delta and Adjacent Lands

3.63 The Mobile Delta extends from the confluence of the Tombigbee and Alabama Rivers southward approximately 45 miles to Mobile Bay at the Battleship Parkway (U.S. Highway 90) and averages about 6 miles wide. Within the 10-foot contour are about 145,000 acres of mostly wetland and aquatic ecosystems (Tucker, 1979; Stout et al., 1982). Most of the area is covered by forested wetlands. The southern portion is mostly freshwater marsh and shallow bays with submersed aquatic vegetation. The main drainage channels are the Mobile and Tensaw Rivers.

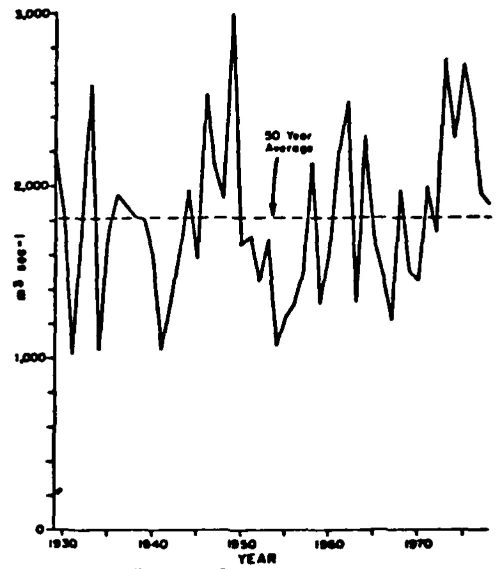
Bathymetry

3.64 The rivers, bays, streams, and marshes of the Mobile River Delta have a water surface area of approximately 20,000 acres and an average depth of 11 feet (Crance, 1971). The Mobile River Delta receives freshwater inflow from 44,000 square miles of land (primarily the Alabama and Tombigbee River basins) covering 64 percent of Alabama and small parts of Georgia and Mississippi. Over 95 percent of the freshwater flow entering Mobile Bay is from the Mobile River Delta. Physical characteristics of the Mobile River Delta are shown in Table 3-12.

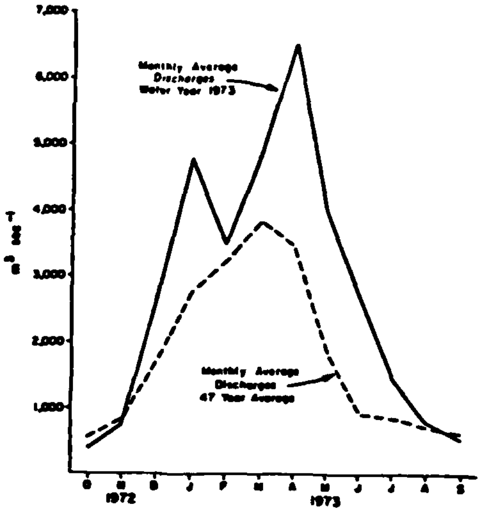
3.65 Water depths in the river channels of the delta vary from 20 feet to over 30 feet. Vertical cross-sections from one side of a channel to the other are mostly U-shaped with steep side slopes. Water depths in bays and creeks off the river channels have much shallower water depths usually ranging between 1 and 3 feet.

Hydrology

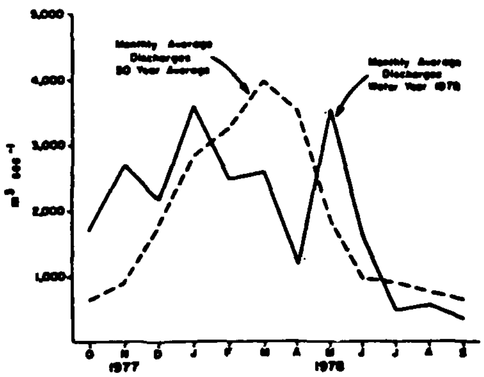
3.66 Flows in the Mobile River Delta vary widely, with a mean annual discharge of 62,300 cubic feet per second (cfs) 40,300 million gallons per day: U.S. Army Corps of Engineers, 1983b). Flow exceeds 30,000 cfs 50 percent of the time (South Alabama Regional Planning Commission, 1979). The maximum monthly discharge occurs during April (133,000 cfs) and the minimum monthly discharge occurs, on the average, during August (17,000 cfs). Other hydrologically significant flow characteristics are listed in Table 3-13. Upon completion of the Tennessee-Tombigbee Waterway, the average flow could increase by as much as 1,560 cfs and the low flow by as much as 250 cfs (U.S. Army Corps of Engineers, 1983b). The variability of freshwater flows from month to month and from year to year can also be seen in the graphs presented in Figure 3-7. The fact that a



Mobile River System Average Discharge into Mobile Bay for Each Water Year Over the Period 1929-1978.



Mobile River System Monthly Average Discharge into Mobile Bay for Water Year 1973 Compared to the 47-Year Average Monthly Discharge (1929-1978).



Mobile River System Monthly Average Discharge into Mobile Bay for Water Year 1978 Compared to the 50-Year Average Monthly Discharges (1929-1978).

Source: Loyacano and Smith, 1980.

FIGURE 3-7
VARIABILITY OF FRESH WATER FLOWS IN THE MOBILE RIVER DELTA

TABLE 3-12

PHYSICAL CHARACTERISTICS OF THE LOWER MOBILE RIVER DELTA

Total area of open water (MHW)	20,323 acres
Area 0 to 1.5 feet deep*	4,860 acres
Area 1.5 to 3.5 feet deep*	4,280 acres
Area 3.5 to 6.5 feet deep*	930 acres
Area 6.5 to 10.5 feet deep*	550 acres
Area 10.5 to 14.5 feet deep*	820 acres
Area 14.5 to 18.5 feet deep*	3,840 acres
Area 18.5 to 30 feet deep*	4,470 acres
Area over 30 feet deep*	573 acres
Average water depth (MHW)	10.84 feet
Volume of open water (MHW)	166,368 acre-feet
Diurnal tide range	1.1 to 1.5 feet
Area of tidal marsh (MHW)	15,257 acres
Length of shoreline of bays	55.4 miles
Length of streams	209.2 miles

*Mean low-water depth. Area at mean low water and mean high water is approximately equal.

Source: Crance, 1971.

TABLE 3-13

HYDROLOGIC STATISTICS FOR THE
MOBILE RIVER SYSTEM

1)	Discharges from Alabama and Tombigbee Rivers to the Mobile River-Delta: 1929 - 1975	
	a) Average	64,100 cfs
	b) 10 percent of flows higher	150,000 cfs
	c) 10 percent of flows lower	13,100 cfs
	d) Instantaneous high flow recorded (March 9, 1961)	539,000 cfs
2)	Maximum changes in discharges	
	a) For 8 to 10-day period	± 140,000 to 210,000 cfs
	b) For 15 to 20-day period	± 280,000 to 350,000 cfs
3)	Median 7-day low flow	12,000 cfs
	7-day, 10-year low flow	8,000 cfs
4)	River discharge categories	
	a) Low	Less than 18,000 cfs
	b) Moderate	18,000 to 110,000 cfs
	c) High	110,000 to 250,000 cfs
	d) Flooding	Greater than 250,000 cfs

Sources: Schroeder, 1979; South Alabama Regional Planning Commission, 1979.

portion of the flows from upstream areas are controlled reservoir releases is another complicating factor. Schroeder (1979) indicates that flows during a 10-day period that fluctuate 4,000 cubic meters per second (141,000 cfs) are not uncommon.

3.67 The average tidal range, which is lower at more upstream locations, is as follows:

Mobile River at Mobile	1.5 feet
Tensaw River at Lower Hall Landing	1.3 feet
Mobile River at Mount Vernon, AL	1.1 feet

Base elevations for the 100-year flood (the common name for a flood which is expected to occur once in 100 years) range from seven feet (ft) above mean sea level at upper Perdido Bay to 13 ft above mean sea level at Mississippi Sound and 11 ft above mean sea level at Mobile Bay (Alabama Coastal Area Board, 1980).

3.68 Circulation fluctuates widely with fluctuating flows and tidal effects. Plumes of suspended materials in the waters of the Mobile River Delta downstream of the Chickasaw Creek tend to remain on the east side of the river and do not mix with waters from the Chickasaw River (South Alabama Regional Planning Commission, 1979). A study by Raney, et al. (1982) showed that during flood events there is a relatively small amount of flow along or across the floodplains. The floodplains in the Mobile River-Delta store a great deal of water, but the majority of water movement is still along the existing channel.

Water Quality

3.69 The following sections summarize the salinity, water temperature, water chemistry and pollutant loadings (point and non-point sources) for the Delta.

3.70 Salinity and Temperature. Intrusion of salinity to the Mobile River Delta from Mobile Bay varies primarily due to variable freshwater flows from upstream and cyclic tidal fluctuations from the Gulf of Mexico. During periods of low flow, salinity can reach 20 miles up the Mobile River Delta, while during high freshwater flows no intrusion takes place (Chermock, 1974; U.S. Army Corps of Engineers, 1982b). Discharges of less than 6,000 cfs of freshwater to the Mobile River-Delta have been documented to result in salinity intrusions from Mobile Bay to the river-delta (Riccio et al., 1973). Higher flows may also still allow salinity intrusion to occur. Peak daily salinity levels can be expected during the first 3 hours following high tide.

3.71 According to the South Alabama Regional Planning Commission (1979), a wedge of salt water beneath the freshwater of the Delta rivers can be maintained as far as 13 miles north of Choctaw Point. Such a wedge is most likely to develop between July and November when freshwater flows from upstream are lowest. At other times waters seem to be well mixed. Salinity contours along a profile of the river for September 23, 1982 are shown in Figure 3-8. During the last week of a 1982 survey by the Alabama Department of Environmental Management, the river flow from upstream reached a minimum of 8,500 cfs, close to the estimated 7-day, 10-year low flow of 8,000 cfs.

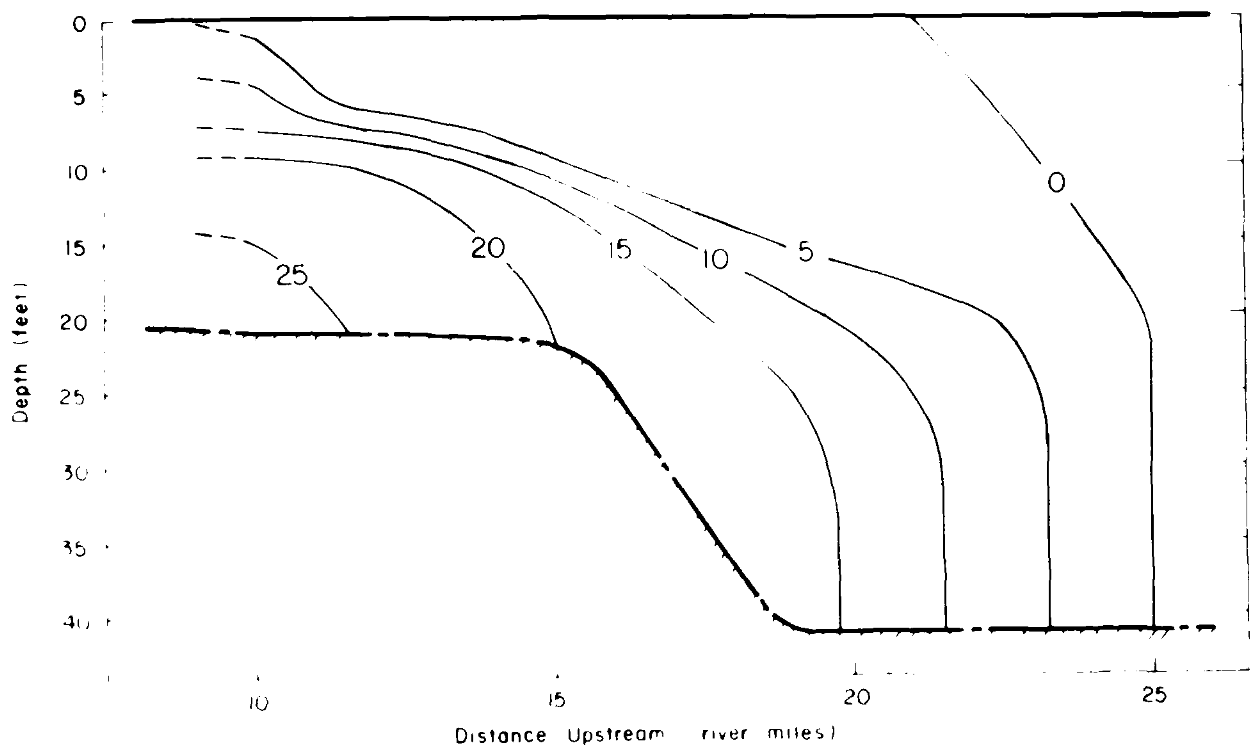
3.72 From December through February, ambient river water temperature ranges between 40 and 55°F. Near the Barry Power Plant 27 miles upstream of the City of Mobile, ambient water temperatures as high as 100°F have been measured. The only other noted water temperature data for the mouth of the Mobile River are for the September to May time period (Nungesser, et al., 1982), when temperatures ranged from lows of 57°F to highs of 82°F with means of 65 to 70°F.

3.73 Water Chemistry. Water quality is dictated by the amounts and types of pollutant loadings, where such loadings are released, and the degree of water circulation due to flows from upstream and tidal effects. Water quality sampling efforts in the Mobile River Delta have been of various intensities extending over specific periods of time/tidal effects. The following provides a synopsis of past sampling efforts reviewed in the literature which help define water quality conditions.

3.74 The lower few miles of the Mobile River downstream of Twelvemile Island generally meet water quality standards throughout the year according to a recent report (South Alabama Regional Planning Commission, 1982d). Ranges of analytical results are as follows: water temperature - 10 to 32 degrees Celsius; pH - 5.7 to 8.0; dissolved oxygen - 2.4 to 10.1 milligrams per liter.

3.75 An initial water quality report by the South Alabama Regional Planning Commission (1979) presents the following water quality assessment information:

> Violations of dissolved oxygen standards (concentrations less than three milligrams per liter) may occur daily at the mouths of tidal streams emanating from urbanized Mobile.
>
> Violations of fecal coliform standards are frequent near Threemile Creek in the vicinity of the lower few miles of the Mobile River.



Source Alabama Department of Environmental Management, 1983.

FIGURE 3-8
SALINITY CONTOURS IN MOBILE RIVER
(PARTS PER THOUSAND) FOR SEPTEMBER 23, 1982

The maximum drop in dissolved oxygen levels for the Mobile River is estimated to be 0.5 milligrams per liter. Hence, the Mobile River is said to be insensitive to localized stormwater runoff.

Under natural conditions, dissolved oxygen levels in bottom waters are less than three milligrams per liter for approximately six months of each year when freshwater flow is low and salinity wedges up the river. Such a wedge can prevent waters from mixing and aerating.

3.76 Annual averages of water quality data show that Chickasaw Creek and Mobile River near the City of Mobile had poorer water quality than sites further upstream on the Mobile River and on the Tensaw River. Most water quality problems in the Mobile Delta are observed near urban and industrial areas. Many industrial wastewaters and some municipal wastes are discharged to Chickasaw Creek. Urban runoff is also a factor.

3.77 Point and Non-Point Source Pollution Entering the Mobile River Delta and Mobile Bay. The type of pollution which most often results in serious pollution problems is sediment from construction and new development. Erosion is also termed a problem along the Mobile River. The significance of each type of runoff is outlined in Table 3-14.

3.78 The largest volumes of discharges enter the Mobile River Delta and Mobile Bay from the Barry steam plant and from paper mills and electric companies. The Barry steam plant, however, does not contribute significant pollutant loadings other than heated blowdown waters. Industrial discharges seem to contribute more oxygen consuming wastes than municipal wastewater discharges. Oxygen demands from runoff will not significantly affect water quality in Chickasaw Creek on the lower Mobile River near the City of Mobile. However, tributary streams will be significantly impacted by runoff during periods of low water flows and high water temperatures (South Alabama Regional Planning Commission, 1979).

3.79 One conclusion presented in the Areawide Water Quality Management Plan is that the national goal of "fishable/swimmable" streams by 1983 will not be completely attainable in the Study area due to the impact of nonpoint source loadings.

3.80 Pollution from runoff varies greatly from location to location and as a function of time. In addition, water quality data to characterize pollution from an entire storm are quite costly and difficult to obtain. The numbers presented in this section to

TABLE 3-14

NONPOINT SOURCE PROBLEM ASSESSMENT SUMMARY

Waters Affected	Type of Problem[a]	Seriousness of Problem[b]	Contributing Source[c]
Chickasaw Creek	DO	M	US
	N	L	US
	P	L	US
	CL	M	HM/SI
	CB	M	US
Three Mile Creek	DO	H	US
	N	L	US
	P	L	US
	SED	H	CON/ND
	CL	M	HM/SI
	CB	M	US
Mobile River	DO	L	US
	N	L	US
	P	L	US
	SED	H	SE/CON/ND
	CL	M	HM/SI
	CB	L/H[d]	UR[e]
Dog River	DO	H	US
	N	H	US
	P	M	US
	SED	H	CON/ND
	CB	M	US
Hall's Mill Creek	DO	H	US
	N	H	US
	P	M	US
	SED	H	CON/ND
	CB	M	US
Deer River	DO	H	US
	N	L	US
	P	L	US
	SED	M	CON/ND
	CL	M	HM/SI
	CB	L	US

Waters Affected	Type of Problem[a]	Seriousness of Problem[b]	Contributing Source[c]
Bayou Sara	DO	H	US
	N	H	US
	P	M	US
	SED	H	CON/ND
	CB	M	US
Eight Mile Creek	DO	M	US
	N	L	US
	P	L	US
	CL	L	HM/SI
	CB	H	US
Mobile Bay	DO	L	US
	N	L	US
	P	L	US
	SED	L/H[f]	US/HM
	CL	M	HM/SI
	CB	L/H[g]	UR[h]
Wolf Creek	N	L	AG[i]
	P	L	AG[i]
	CB	M	LSD[j]
Magnolia River	N	L	AG[i]
	P	L	AG[i]
	CB	M	LSD[j]
Fish River	CB	M	LSD[j]
Fowl River	CB	M	LSD[j]
Coastal Waters around Dauphin Island and Gulf Shores	CB	M	LSD[j]

Notes

[a]DO: Dissolved Oxygen
N: Nitrogen
P: Phosphorus
CL: Coliform Bacteria
SED: Sediment

[b]L: Low
M: Medium
H: High

[c]US: Urban Stormwater
HM: Hydrologic Modification
SI: Saltwater Intrusion
CON: Construction
ND: New Development
SE: Stream Erosion
UR: Upstream Runoff
AG: Agriculture/Pastureland
LSD: Land and Subsurface Disposal

[d]Not serious most of the year; however, during the winter low temperature, high flow period bacterial contamination in the River and Bay becomes serious enough to cause closure of the oyster reefs.

[e]Upstream runoff is probably a combination of urban stormwater from developed areas and runoff from agriculture/pastureland uses in areas drained by the River.

[f]Not serious most of the year with normal deposition of sediment occurring from stream flow; however, during peak flow periods and during dredging and spoil disposal

Notes continued on next page.

TABLE 3-14 (Concluded)

Notes continued from Table

activities, deposition of sediment becomes a serious non-point source problem.

[g]Not serious most of the year; however, during the winter low temperature, high flow period, bacterial contamination in the River and Bay becomes serious enough to cause closure of the oyster reefs.

[h]Upstream runoff is probably a combination of urban stormwater from developed areas and runoff from agriculture/pastureland uses in areas drained by the Mobile River Delta and its tributary streams. Model simulations showed conclusively that elevated bacterial counts causing closure of the oyster reefs did not come from municipal point sources.

[i]These nutrients were detected above background levels during the course of the sampling program; however, they were not in amounts sufficient to cause any violation of stream standards. Since they could not be traced to any point sources, it was assumed that they were non-point source contributions from the agriculture/pastureland activities carried on in the area.

[j]Problems associated with bacterial contamination of coastal waters and resort areas were documented in recent EPA studies to emanate from overloaded and/or improperly functioning septic tank systems in these low-lying areas. It is also believed that such problems may contribute to the fecal coliform loadings that annually close the oyster reefs.

Source: Loyacano and Smith, 1980

characterize runoff pollution are certainly less precise than numbers presented to characterize industrial and municipal wastewaters.

Sediments

3.81 The Mobile River system carries an annual average of 4.3 million metric tons of suspended sediments to Mobile Bay (U.S. Army Corps of Engineers, 1978a). The Mobile River Delta shoreline has shown a net tendency to release rather than accumulate sediments (Alabama Coastal Area Board, 1980). Erosion occurs principally in the banks of the major river channels, while accumulation of sediments occurs where water velocities are low. Overall, the Mobile River Delta lost 22 acres of land between 1917 and 1967 (Hardin, et at., 1976). No information about physical or chemical characteristics of Delta sediments has been found.

Wetland Ecosystems

3.82 Wetlands within the Mobile Delta consist of two types (Figure 3-9). These are forested swamp dominated by woody shrubs and trees, and non-forested marshes characterized by rooted perennial herbaceous plants. Forested wetlands comprise about 100,000 acres. Non-forested marshes occupy about 10,600 acres and occur mostly in the southern portion in the vicinity of the Battleship Parkway.

3.83 Forested Wetlands. Six distinct vegetation communities have been identified within the Mobile Delta (Stout et al., 1982):

Vegetation Community Type	Acres	Percent of Total
Alluvial Swamp	33,966	34
Deep Alluvial Swamp	35,301	35
Natural Levee	26,564	27
Bay Forest	3,291	3
Moist Pine Forest	832	1
Moist Pine Savannah	60	1
TOTAL	100,014	100

The first three community types constitute 96 percent of the forested area.

3.84 Natural levee and deep alluvial swamp communities are prevalent from the northern end of the Delta to the vicinity of the I-65 bridge (Figure 3-9). South of I-65 the alluvial swamp community is dominant. Bay forests occur mainly along several tributary streams flowing into the Delta from the adjacent upland.

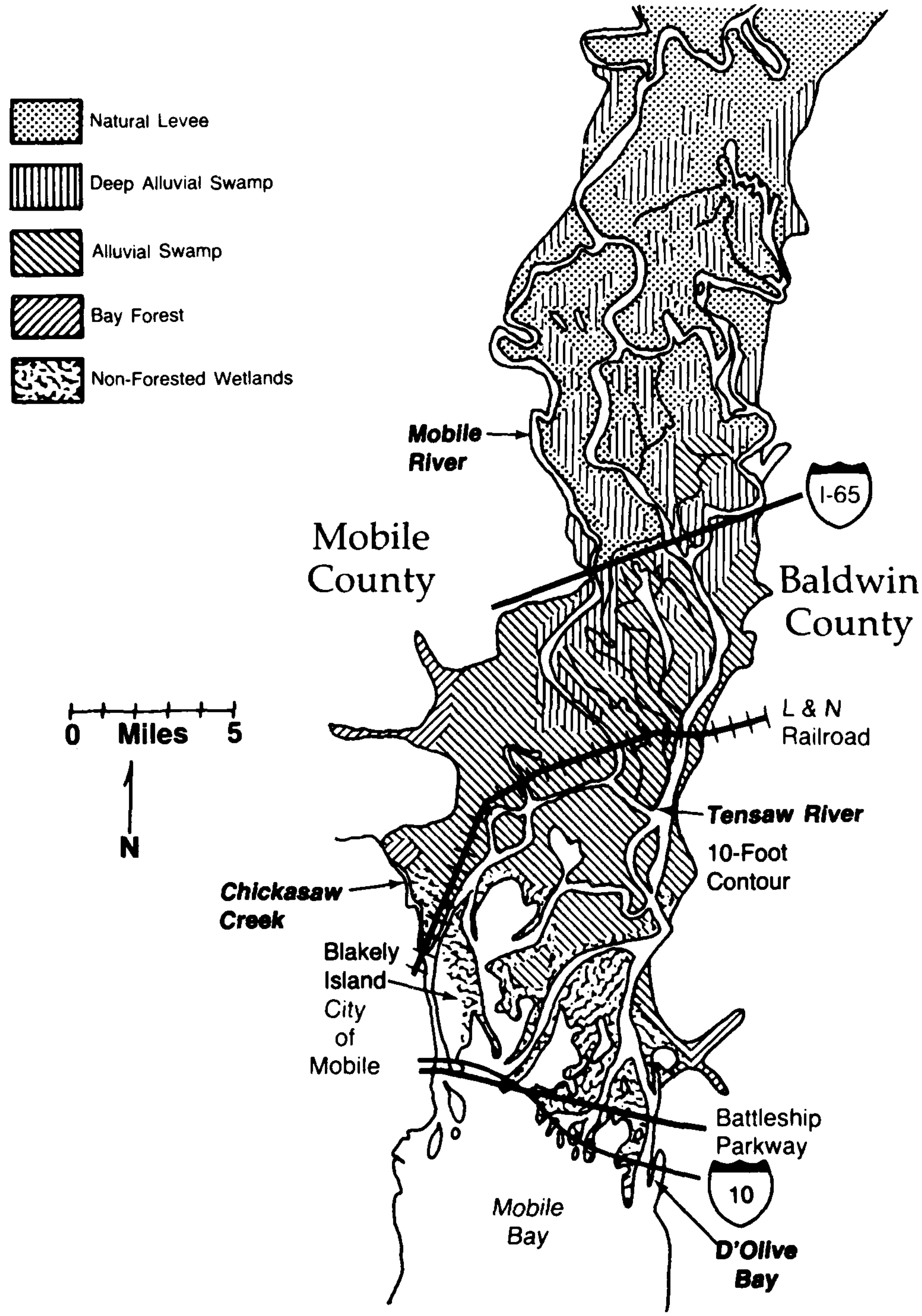


FIGURE 3-9
WETLAND COMMUNITIES IN THE MOBILE DELTA

Moist pine forest and moist pine savannah are restricted to a few topographic rises within the interior of the Delta and along the margins approaching the 10-foot contour.

3.85 The distribution of forested vegetation communities within the Delta is a function primarily of the frequency, depth and duration of flooding and anaerobic conditions within the soils (Stout et al., 1982; Wharton et al., 1982). Other factors can include soil characteristics, detrital decomposition rates, soil and water pH, nutrient availability and turnover rates, flood depth and water velocity, light intensity and disturbance (Wharton et al., 1982). Many years of logging operations in the Delta may have altered vegetation community composition, especially the effect of the removal of very large cypress trees (Stout and Dowling, 1982; Wharton et al., 1982).

3.86 Frequency, depth and duration of flooding, and soil anaerobiosis at any site within the Delta are partly determined by the elevation of the site, which, in turn, is a function of sediment deposition patterns within the Delta. During periods of high river flow (typically late winter and early spring) floodwaters exceed the capacity of the channels and spread out over the adjacent forested wetland floodplain. Because current velocities are less on the floodplain, turbulent energy to maintain sediments in suspension is reduced and sediments are deposited. Coarser material is deposited first on the banks adjacent to the channel resulting in natural levees sloping to lower elevations away from the channels. This morphological pattern is evident from the distribution of natural levee communities along the main channels in the northern Delta.

3.87 Heaviest deposition of sediment probably occurs in the northern Delta and decreases to the south as less sediment is available for deposition. While no studies of this have been undertaken in the Delta, the disappearance of higher elevation levees along the channels may be an indication that such a deposition pattern occurs.

3.88 The composition of the Delta vegetation communities has been described by Stout et al. (1982). The natural levee vegetation community is characterized by less frequent and shorter duration flooding and better drained soils because of the higher elevations. On higher, better drained sites are found less flood-tolerant canopy species such as swamp chestnut oak (Quercus michauxii), pignut hickory (Carya glabra), southern magnolia (Magnolia grandiflora) and live oak (Q. virginiana). Wetter sites contain water hickory (Carya aquatica), hackberry (Celtis laevigata), american elm (Ulmus americana), sweetgum (Liquidambar styraciflua), water oak (Q. nigra), willow oak (Q. phellos) and overcup oak (Q. lyrata). An expanded

list of common plant species occuring in the natural levee communities is in Appendix D.

3.89 The deep alluvial swamp community is found in areas that are deeply flooded for prolonged periods. Small variations in soil characteristics, topography or drainage may result in marked changes in species dominance among sites within this community. Where flooding is relatively constant the dominent trees are almost exclusively water tupelo (Nyssa aquatica) and bald cypress (Taxodium distichum). Where the depth and duration of flooding is less, additional co-dominants occur. These commonly include red maple (Acer rubrum), laurel oak (Q. laurifolia), and swamp tupelo (Nyssa sylvatica var. biflora). Less common are green ash (Fraxinus pennsylvanica), sweet gum and swamp cottonwood (Populus heterophylla). Subcanopy development may be limited. See Appendix D for an expanded list of species.

3.90 The alluvial swamp community occurs mainly in the southern half of the Delta where floodplain elevations are lower and periods of seasonal inundation are shorter. Relatively flood-tolerant species such as swamp tupelo, red maple, green ash, pumpkin ash (F. profunda), swamp cottonwood, and overcup oak are common. Extremely flood-tolerant bald cypress and water tupelo also occur. Shade tolerant shrubs and ground layer species may occur under the canopy (see Appendix D).

3.91 While the vegetation structure of the forested Delta has been investigated (see above), the functional aspects of the ecosystem such as primary production, nutrient cycling, detritus, and habitat value have not. Comparison of the vegetation communities in the Delta with data from other southeastern floodplain systems indicates that much of the knowledge gained in other systems is probably applicable to the Delta situation. Much of the available literature of floodplain ecosystems has been reviewed, summarized and synthesized in Wharton et al. (1982), which serves as the basis for much of the discussion below.

3.92 Primary production of forested wetlands is as high as or greater than upland forested ecosystems. This is a result of chemical and physical subsidies provided to the ecosystem by the flooding regime. These include particulate and dissolved organic matter, water, soil and nutrients. The high productivity of floodplain wetlands is also partly a function of the alternating wet-dry cycle. Results of a number of studies indicate that the most productive communities are the ones receiving flooding about once per year. Permanently wet sites and sites wet for extensive periods may be less productive. In the Delta this suggests that the higher elevation sites such as the natural levee communities would be the most productive.

3.93 Shrubs and herbaceous ground covers also contribute significantly to community primary productivity but have been less well studied. For example, rover cane (Arundinaria gigantea) can produce up to 4000 pounds of organic matter per acre per year. The contribution of woody vines to primary production could be large locally (Wharton et al., 1982).

3.94 The fauna of the Delta has not been studied extensively. Inferences concerning the Delta can be made from knowledge of other floodplain ecosystems, however. The animal communities may be partly a function of the hydrologic regimes, as are the vegetation communities. The focus of the discussion below is on the trophic relationships and functional aspects of the animal community rather than a listing of species. Details on species may be found in Wharton et al. (1981, 1982).

3.95 In general, the animal communities within the floodplain can be divided into a dry system and a wet system. The dry system may be characteristic of the higher elevation communities within the Delta, such as the natural levee communities, that may be inundated only during the late winter-early spring high flow period and lower elevation areas that experience a drydown during low flow periods. The dry system has both a detrital processing component and a grazing component. The detrital processing occurs in the litter layer on the forest floor. This component is similar to that found in upland forests. The grazing component utilizes many of the products of the floodplain vegetation, such as nuts, berries, leaves and bark.

3.96 The wet system functions during periods of inundation and is primarily a detritus processing or detritus utilizing system.

3.97 Forested wetlands are important habitats for birds (literature summary in Wharton et al., 1981). Densities of individuals may be greater than on upland ecosystems. Species diversity may be similar to upland sites. The drier high elevation community types may be most valuable because of the production of mast by nutbearing trees.

3.98 Large populations of overwintering birds can be found in southeastern forested wetlands. These populations are supported by the nut, fruit and berry production of oaks, tupelo, sugarberry (Celtis laevigata) possumhaw (Ilex decidua), grapes (Vitis spp.), and other species.

3.99 Forested wetlands are probably important feeding areas for waterfowl overwintering in the Delta region. For example, mallards prefer to feed on acorns when they float during periods of inundation of the floodplain (Wharton, 1982). Wood ducks have been

found to switch 70 percent of their diets during the egglaying season to invertebrates obtained from flooded forested wetlands (Wharton, 1981).

3.100 Forested wetland areas are important feeding and spawning habitat for fish during periods of inundation (literature reviews in Wharton et al., 1981, 1982). At least 20 families and up to 53 species of fish spawn and/or feed on inundated floodplains. Because of this, many fish life cycles are keyed to the annual pattern of inundation, and population distribution and abundance can be affected by year-to-year variations in flooding. For example, the time and extent of annual floodplain inundation can affect the size of year classes of black bass and sunfish. In the Atchafalaya Basin, Louisiana, spawning of 7 out of 10 of the most common fish taxa occurred in floodplain habitats. The floodplain is a nursery area for about one-half of the fishes of the lower Mississippi River.

3.101 The findings of a workgroup at a workshop on forested floodplain ecosystems regarding the importance of this system to fish are as follows (as summarized in Wharton, (1981)): (1) because of high mortality rates in early stages, survival and rapid growth of larval fish are enhanced by the inundated vegetation; (2) top level piscivores (gar, bowfin, pickerel) spawn early, their precocious young can forage on the early stages of later spawns by other species; (3) species indigenous to small feeder streams and floodplain lakes (darters, some minnows, topminnows, some suckers, pigmy sunfishes and mosquito fish) either spawn early in tributaries or migrate to inundated forested floodplains to spawn; (4) whether by passive movement of larvae with local spates or by catadromous pre-spawning migration as adults, young fish are abundant in inundated forested floodplains of large rivers from later winter until waters recede; (5) the larvae of riverine primary consumers or detrital sifters (carp, some minnows, buffalofish, shad) appear in quiet water over forested floodplains; shad and sucker larvae grow rapidly and are prepared to leave the floodplain quickly; (6) in early spring, larval crappies are abundant; basses and sunfish larvae appear in summer in inundated forested floodplains; (7) larval centrarchids may appear over inundated forested floodplains for protracted periods because they produce multiple spawn or spawn chronologically by age class; (8) catfish can spawn in main channels if conditions are right, but if not, may spawn on the floodplain utilizing hollow logs or other shelter; (9) pelagic spawners such as drum and percichthyid basses are among the few fish whose life history may not involve forested floodplains, although their larvae may be locally abundant on the floodplain; (10) pre-reproduction food intake by adult fish provided by food-rich inundated forested floodplains may be crucial for development of gonadal tissues.

3.102 Non-Forested Marshes. The non-forested marshes of the southern portion of the Delta (Figure 3-9) consist of low marsh and high marsh vegetation communities (Stout et al., 1982). Non-forested marshes in the Delta used to occupy about 13,900 acres. Human activities to date, mostly in the industrial area along the Mobile River at the city of Mobile, have resulted in the loss of about 3300 acres, leaving about 10,600 acres currently unaltered.

3.103 Low marshes occupy shallow flats of the large bays and the lower slopes of the smaller slower moving water courses, areas that are frequently but irregularly flooded. Sedges, grasses and rushes are the dominant vegetation. Commonly occuring are panic grass (Panicum gymnocarpon), wild rice (Zizania aquatica, Zizaniopsis miliacea) and sawgrass (Cladium jamaicense). Other species include beak rushes (Rynchospora spp.), spike rushes (Eleocharis spp.), umbrella sedges (Cyperus spp.) and rushes (Juncus spp.). Alligator weed (Alternanthera philoxerides), arrowhead (Sagittaria falcata, S. latifolia) or cattails (Typha latifolia, T. domingensis) are sometimes dominant. A few shrubs and trees may occur, such as button bush (Cephalanthus occindentalis), swamp tupelo (N. sylvatica var. biflora), swamp dogwood (Cornus stricta) and bald cyress (T. distichumm) (Stout et al., 1982). A more complete list of vegetation species is given in Appendix D.

3.104 The high marsh community occurs on the higher levee areas along the major drainage channels. Grasses or sedges are often the dominant vegetation. These include common reed (Phragmites australis), cordgrass (Spartina cynosuroides, S. patens), switch grass (Panicum virgatum) and Carex hyalinolepis. Trees and shrubs occur more frequently than in the low marsh community. These include wax myrtle (Myrica cerifera), elderberry (Sambucus canadensis), bastard indigo (Amorpha fruiticosa), marsh mallows (Hibiscus militaris, Kosteletzkya virginica), black willow (Salix nigra), yaupon (Ilex vomitoria) and sea myrtle (Baccharis halimifolia) (Stout et al., 1982).

Aquatic Ecosystems

3.105 The Mobile Delta has about 30,000 acres of open water habitat (Tucker, 1979). These areas are the major flow channels, smaller drainage channels and the large open bays of the southern portion of the Delta. The aquatic ecosystem is composed of a diverse population of submersed aquatic vegetation and resident and migratory invertebrate and vertebrate species supported mainly by particulate organic matter (detritus) derived from the primary production of the forested and non-forested wetland areas.

3.106 Submersed and Floating Aquatic Vegetation. About 3700 acres of submersed aquatic vegetation occurs in the Delta, most in the shallow bays of the southern Delta. The large flow channels are too deep and fast flowing to support much submersed vegetation except in scattered patches. Smaller tributary channels, however, may have bands of submersed vegetation along the banks (Stout et al., 1982).

3.107 The dominant submersed aquatic species can vary considerably from year to year depending on river flow, but commonly occuring species include bushy pondweed (Nais guadalupensis), wild celery (Vallisneria americana charophytes), slender pondweed (Potamogeton pusillus), horned pondweed (Zannichellia pallustris), muskgrasses (Nitella sp.), clasp leaf pondweed (P. perfoliatus), long-leaf pondweed (P. nodosus), water stargrass (Heteranthera dubia), coontail (Ceratophyllum demersum), fanwart (Cabomba caroliniana), and Eurasian watermilfoil (Myriophyllum spicatum) (Beshears, undated; Stout et al., 1982).

3.108 Eurasian water milfoil has taken over much of the shallow southern bay areas. The current area covered is about 3,000 to 3,500 acres (Nestor, 1983, Personal communication). A selective herbicide spray program is carried out by the District to maintain some boat channels through the growth areas. The floating water hyacinth (not a submersed species) has also been a nuisance in some years. Selective spraying of herbicide has been used in the past to control this species, but has not been used in several years. Cold winters periodically reduce the hyacinth population (Beshears, undated). The hyacinth population has increased in the last several years (Nestor, 1983, Personal communication).

3.109 Invertebrate Communities. Aquatic invertebrate communities of the Delta have not been studied, but may be similar to other coastal floodplain river systems. The invertebrate community obtains energy from the large quantity of detritus exported from the adjacent wetlands. Only an overview of this community is presented here. More information can be found in Wharton et al. (1981, 1982).

3.110 Protozoan forms may be common. Dominant species may vary greatly from place to place. Larger zooplankton are typically rotifers, cladocerans (water fleas) and cyclopoid copepods. It is likely that the dominant zooplankton species vary in Delta among the main river channels, smaller drainage channels, and the southern bays that are more saline at low river flow stages.

3.111 Macroinvertebrates consist of animals living on or in the bottom, on sunken wood "snags", and drift organisms living

within the water column. Included are clams, worms, snails, crawfish, and aquatic insect larvae. In the Atchafalaya River Basin in Louisiana common macroinvertebrates were phantom midges, midge flies, biting midge, tubificid worms, isopods, amphipods, damsel flies, mayflies and fingernail clams. Open water habitats tended to have more midge larvae, snails and tubificid worms than tupelo-cypress habitats (Bryan et al., 1976 as summarized in Wharton, 1981). Detritus habitats, such as tupelo-cypress areas had greater densities of organisms than silt, sand or clay substrates typical of channel bottoms. Sphaeriid clams, tubificid worms, isopods, amphipods and dipterans increased with an increase in detritus (Beck, 1977, cited in Wharton et al., 1981). Crawfish biomass may be quite high on the floodplain areas, but make up a smaller portion of the channel communities. The crawfish is an important food item for many larger predators within the channel-floodplain ecosystem (Wharton, 1981). High densities of organisms may be found on "snags" in the channel systems (Wharton et al., 1982).

3.112 Fish. At least 26 families and 115 species of fish have been reported from the Mobile Delta (Tucker, 1979). Most of these are freshwater species, but include marine species that are found in the southern Delta when salinity increases during low-flow periods. A list of fishes found in the Delta is given in Appendix D.

3.113 An extensive sport fishery exists in the Delta (see section on tourism and outdoor recreation). Species of principal interest include largemouth bass, bluegill, redear sunfish, spotted sunfish, warmouth, green sunfish, spotted bass, black crappie, white crappie, yellow bass, striped bass, chain pickerel, various catfishes, aligator gar, bowfin and mullet (Tucker, 1979). A recent creel survey estimated the Delta harvest to be 749,000 pounds per year (active and passive gear fishery)(Malvestuto et al., 1983).

3.114 A commercial fishery also exploits the Delta fish population, seeking primarily catfishes and smallmouth buffalo (Tucker, 1979)(see section on Delta commercial fisheries). Harvest has been estimated at 640,000 pounds annually (Malvestuto et al., 1983).

3.115 Many species in the fish community are dependent on adjacent wetland areas for spawning and feeding during periods of inundation (see discussion of the forested wetland ecosystem). The fish community also is supported by detritus-based food web living off primary production exported from wetland areas.

3.116 Waterfowl. The southern Mobile Delta is an important waterfowl overwintering habitat. Ninety-five percent of the winter population in the Mobile Delta-Mobile Bay region is found there. Twenty species of ducks have been recorded, with lesser scaup,

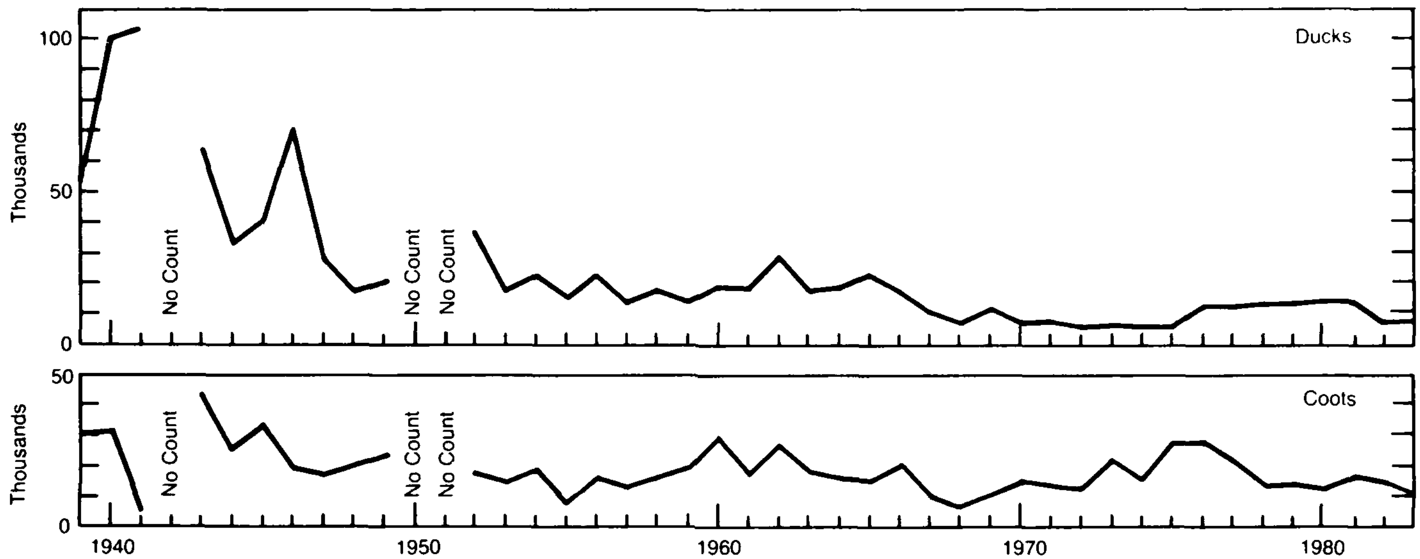
gadwall, greenwinged teal, mallard, wigeon, ringneck and pintail the most important species. The American coot also occurs in large numbers (Beshears, 1979), but few geese have been observed. These populations support a winter waterfowl hunting season (see section on tourism and outdoor recreation).

3.117 Waterfowl counts have been made annually for the southern Delta (including the area extending about 3 miles south of the Battleship Parkway) from 1939 through 1949 and 1952 to the present (Figure 3-10). Year-to-year variations in the winter population have been large. Ducks have varied from 100,000 in 1940 and 1941 to about 5000 in 1972 and 1974. Coots have varied from 44,000 in 1943 to 6000 in 1941. Most of these birds are migrants or winter residents only; only a small number of wood duck and mottled duck are breeders and summer residents (Beshears, 1979).

3.118 Several factors have affected the size of the yearly overwintering population in the Delta. These include the disappearance of continental breeding habitat, size of the continental population, the coldness of the continental winter and the increased number of refuges available for overwintering further north ("short-stopping"). The recent spread of Eurasian water milfoil throughout the southern Delta, replacing submersed aquatic species more desirable as duck food (see section on submersed aquatic vegetation) may also have had some effect (Beshears, 1979).

3.119 Coupling of the Delta Aquatic Ecosystem With Adjacent Wetlands. The aquatic ecosystem of the Delta is coupled to the adjacent wetland ecosystems by inundation during high river flow periods and through the seasonal exchange of some animals, such as migratory fish. The use of the inundated floodplain by fish for breeding and spawning has been discussed in the section on forested wetlands.

3.120 An important link between the floodplain and the aquatic environment is the export of much of the primary production of the forested wetland area to the aquatic food web in the form of detritus (Wharton et al., 1982). The emergent vegetation in the non-forested portion of Delta would also contribute detritus to the aquatic system. Detritus derived from leaves and twigs is in the form of coarse particulate organic matter, fine particulate organic matter and dissolved organic matter. After autumn leaf fall, the leaves are enriched by bacteria and aquatic fungi that grow on them. Insect larvae, crayfish and amphipods shred the leaf material, reducing it to fine particulate organic matter. The feces of scraper organisms grazing on the coarse particulate organic matter also contribute to the pool of fine particulate matter.



Source U.S. Fish and Wildlife Service, Starkville, MS ; Beshears, 1979.

FIGURE 3-10
JANUARY COUNTS OF WINTERING POPULATIONS OF DUCKS AND COOTS IN THE MOBILE DELTA

During periods of inundation of the floodplain, the detrital material becomes available to aquatic organisms. Additionally, much of the detritus is carried to the channels, where it serves as the main energy source for many invertebrate species, which obtain it from the sediments or filter it from the water.

3.121 Coupling of the Mobile Delta Ecosystem with the Mobile Bay Ecosystem. The ecosystem of the Mobile Delta and Mobile Bay are linked by several factors. The physical and chemical environment and, thus, the biological community of Mobile Bay is strongly influenced by the seasonality of the inflow of freshwater from the Delta. Organic matter produced by vegetation on the floodplain of the Delta may be carried to Mobile Bay, where it serves as an energy source to the bay ecosystem. Seasonal movement of fish between the bay and the Delta may also occur.

3.122 The export of organic matter in the form of detritus from the Delta to Mobile Bay is probably an important link between the two ecosystems. No data on detritus export from the Delta are available, but it is likely that data from a 5-year study of the Apalachicola Bay-Apalachicola River system to the east in Florida (Livingston et al., 1976) are relevant to the Delta-Mobile Bay system. In general, in Apalachicola Bay, there was an association of the presence of particulate matter in the bay with high river flow and periodic flooding the forested flood plain of the Apalachicola River over the 5-year study period. Mean river flow and peak river flooding was important in determining the amount of detritus entering Apalachicola Bay. Based on a rough calculation of the energy budget of the bay, it was estimated that detritus from the river system was comparable to phytoplankton production as a source of energy to the food web on the bay.

3.123 Several species of anadromous fish migrate into the Delta from Mobile Bay and the nearshore Gulf of Mexico (Tucker, 1979). During low river flow saline water penetrates into the southern Delta. A salt wedge may extend many miles northward up the deeper channels. Some estuarine species may utilize suitable portions of the Delta during this time.

Upland Ecosystems Adjacent to the Mobile Delta

3.124 The original upland ecosystems adjacent to the Mobile Delta were the longleaf pine-oak community on drier sites and pine savannah community on wetter sites. These communities have been removed or altered throughout much of the area. Currently, much of the area is a mixture of agriculture, pasture, rural residences, industry, and pine-oak and pine savannah woodlands. In the vicinity of the city of Mobile, the upland area is principally in urban residential, commercial and industrial uses.

Threatened and Endangered Species

3.125 The U.S. Department of the Interior maintains a list of animal and plant species that are threatened and endangered in the United States. Scientists from the state of Alabama have also compiled a list of species that are considered threatened and endangered in Alabama (Boschung, 1976). However, the list is unofficial. Plants and animals from these lists that could occur in the Mobile Delta vicinity are given in Tables 3-15 and 3-16.

Mobile Bay and Adjacent Areas

3.126 Mobile Bay extends about 30 miles from the mouths of the Mobile and Tensaw rivers in the north to Pelican Point and Fort Morgan to the south, which mark the pass to the Gulf of Mexico. The Bay is shallow, averaging only 9.7 feet deep, but is crossed from north to south by the 40-foot deep Mobile Ship Channel from the Gulf to the port of Mobile and east to west in the southern part of the Bay by the 12-foot deep Intracoastal Waterway. The physical, chemical and biological characteristics of the bay are heavily influenced by the discharge of the Mobile-Tensaw River system, the fourth largest discharge of U.S. river basins.

3.127 Only a summary overview of the characteristics of Mobile Bay is given below, since the area has been described extensively in other environmental impact statements and environmental studies on proposed activities within the bay (U.S. Army Corps of Engineers, 1973, 1975a, 1975b, 1977, 1979a, 1980, 1982a, 1982b, 1983b, also see Bibliography). This follows the guidance of the U.S. Council on Environmental Quality regarding incorporation of information by reference in the environmental impact statement preparation process. The reader is referred to the Bibliography for additional source documents of Mobile Bay.

Bathymetry

3.128 Bathymetry at the main southern entrance to Mobile Bay and at passes adjacent to Little Dauphin Island is primarily influenced by dredging and disposal of dredged material. Passes that are not dredged are closing (Hardin, et al., 1976). Bathymetry of Mobile Bay is shown in Figure 3-11.

3.129 Several manmade navigation channels have been dredged in Mobile Bay. The Mobile Ship Channel is the longest, extending 29 miles from the Port of Mobile to the Main Pass to the Gulf of Mexico. The second longest channel is the Intracoastal Waterway, connecting Mobile Bay with Mississippi Sound through Pass aux Herons and Perdido Bay. Dredging of the Theodore Industrial Park channel

TABLE 3-15

ENDANGERED AND THREATENED ANIMALS THAT COULD OCCUR IN THE MOBILE DELTA VICINITY

Common Name	Scientific Name	Status Alabama	Status Federal
MAMMALS			
Florida Black Bear	Ursus americanus floridanus	E	
Florida Panther	Felis concolor coryi	E	E
BIRDS			
Bald Eagle	Haliaeetus leucocephalus	E	E
Red-Cockaded Woodpecker	Picoides borealis	E	E
Peregrin Falcon	Falco peregrinus	E	E
Brown Pelican	Pelecanus occidentalis	E	E
Osprey	Pandion haliaetus	E	
Mottled Duck	Anus fulvigula	T	
AMPHIBIANS AND REPTILES			
Gopher Tortoise	Gopherus polyphemus	T	
Alabama Red-Bellied Turtle	Pseudemys alabamensis	T	
Eastern Indigo Snake	Drymarchon corais couperi	E	T
Black Pine Snake	Pitophis melanoleucus lodingi	E	
American Alligator	Alligator mississippiensis	T	T
Flatwoods Salamander	Ambystoma cingulatum	E	
Dusky Gopher Frog	Rana areolata sevosa	T	
FISH			
Alabama Shovelnose Sturgeon	Scaphirhynchus sp.	E	
Atlantic Surgeon	Acipenser oxyrhycus	T	
Blue Sucker	Cycleptus elongatus	T	
Crystal Darter	Ammocrypta asprella	T	
Freckled Darter	Percina lenticula	T	

E=Endangered
T=Threatened

Alabama list is unofficial.

Source: U.S. Army Corps of Engineers, 1981a, 1983b.

TABLE 3-16

PLANTS THAT MAY OCCUR IN THE MOBILE DELTA VICINITY CONSIDERED ENDANGERED, THREATENED OR OF SPECIAL CONCERN

Scientific Name	Common Name	Status
Hypericum nitidum	St. Johns wort	T
Hypericum reductum	St. Johns wort	SC
Juncus gymnocarpus		T
Pinguicula planifolia	Butterwort	SC
Pinguicula primulifora	Butterwort	SC
Utricularia floridana	Bladderwort	T
Utricularia inflata	Bladderwort	T
Utricularia purpurea	Bladderwort	T
Lilium iridollae	Lily	E
Pleea tenuifolia	Rush featherline	SC
Lycopodium cernuum	Clubmoss	SC
Ludwigia arcuata		T
Oenothera grandiflora	Evening primrose	E
Botrychium alabamense	Alabama grapefern	SC
Botrychium lunarioides	Winter grapefern	SC
Ophioglossum crotalophoroides	Bulbous adders tongue	SC
Ophioglossum nudicaule	Least adders tongue	SC
Cleistes divaricata	Spreading pogonia	T
Epidendrum conopseum	Green-fly orchid	E
Platanthera integra	Yellow fringeless orchid	SC
Orobanche uniflora		SC
Manisuris tuberculosa	Jointgrass	SC
Panicum nudicaule		T
Potomogeton robbinsii	Pondweed	E
Segeretia minutiflora		T
Sarracenia psittacina	Pitcher-plant	T
Sarracenia rubra	Sweet pitcher plant	T
Agalinis pseudophylla		SC
Penstemon multiflorus		SC
Selaginella ludoviciana	Spikemoss	SC
Gordonia lasianthus	Loblolly bay	T

E - Endangered, T - Threatened, SC - Special concern.

Alabama list is unofficial.

Source: U.S. Army Corps of Engineers, 1983b.

TABLE 3-16 (Concluded)

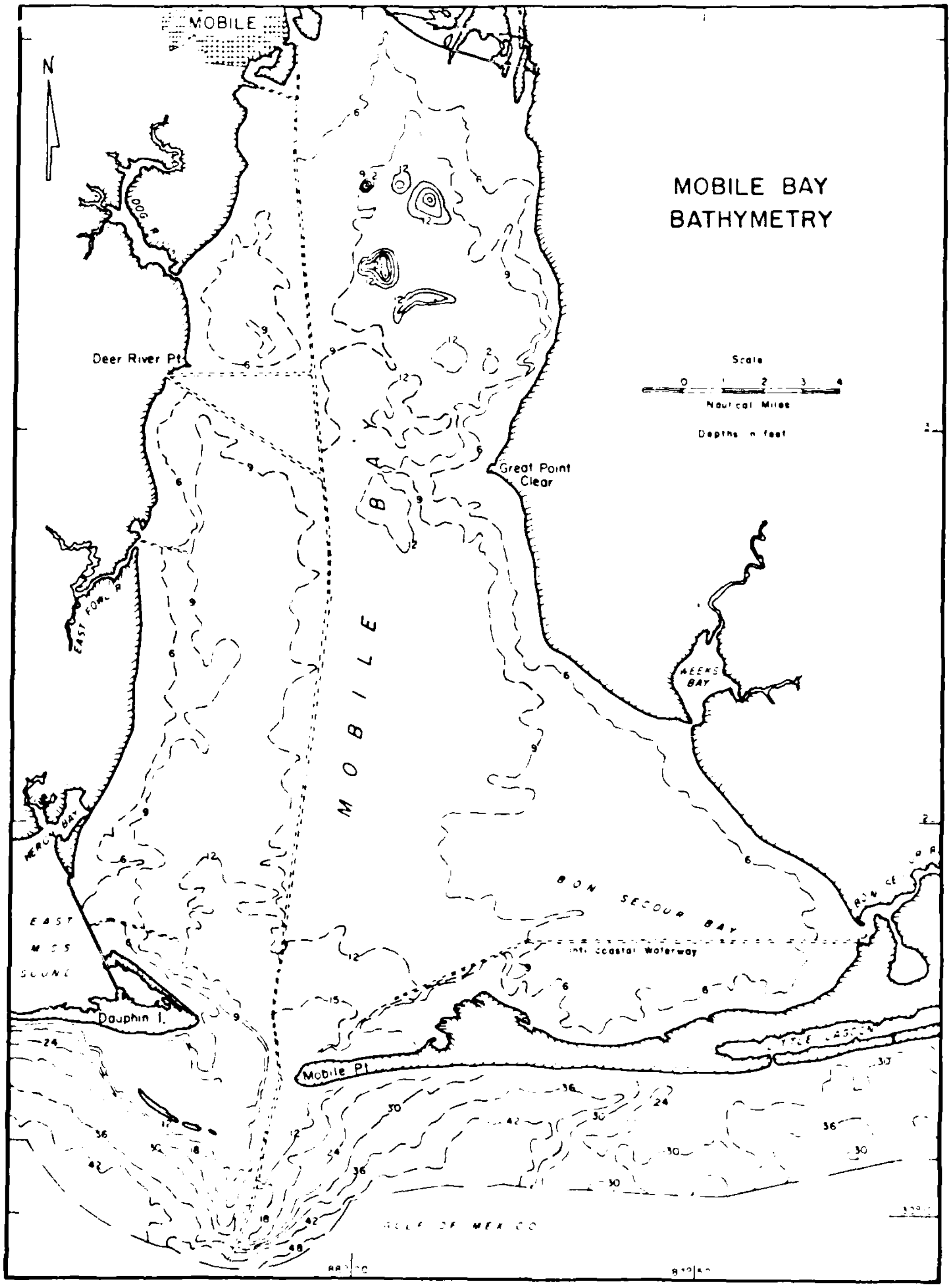
PLANTS THAT MAY OCCUR IN THE MOBILE DELTA VICINITY CONSIDERED ENDANGERED, THREATENED OR OF SPECIAL CONCERN

Scientific Name	Common Name	Status
Stewartia malacodendron	Silky camellia	SC
Momisia iguanea		T
Xyris drummondii	Yellow-eyed grass	T
Xyris scabrifolia	Yellow-eyed grass	T
Illex amelanchier		E[a]
Acorus calamus	Sweet flag	T
Peltandra sagittaefolia	Spoon flower	T
Thelypteris dentata	Fern	SC
Thelypteris ovata	Fern	SC
Thelypteris quadrangularis	Fern	SC
Liatris chapmanii	Blazing star	SC
Canna flaccida	Golden canna	T
Cleome tenuifolia	Spider flower	SC
Clethra alnifolia	White alder	SC
Chamaecyparis thyoides	Juniper	SC
Rhynchospora crinipes	Horned rush	E
Kalmia hirsuta		SC
Pieris phillyreifolia		T
Rhododendron austrinum		SC
Eriocaulon lineare	Pipewort	SC
Eriocaulon texenes	Pipewort	SC
Psoralea simplex		E
Quercus minima	Dwarf live oak	SC
Quercus pumila	Running oak	SC
Eustoma exaltatum		SC
Gentiana villosa		E
Sabatia brevifolia		T
Sabatia foliosa		SC

E - Endangered, T - Threatened, SC - Special concern.

Alabama list is unofficial.

Source: U.S. Army Corps of Engineers, 1983b.



Source U S Dept of Commerce, 1982f

FIGURE 3-11
MOBILE BAY BATHYMETRY

has resulted in a large dredge spoil island which affects localized water circulation.

3.130 Mobile Bay has an open water surface area at mean high tide of 264,000 acres; the Bay's average depth is 9.7 feet. Average depth west of the main ship channel is 9.4 feet and east of the main channel the average depth is 9.9 feet (Chermock, 1974). During 1961, the highest known flow in the Mobile River-Delta increased water levels in the northern portion (head) of the bay by approximately two feet (Chermock, 1974).

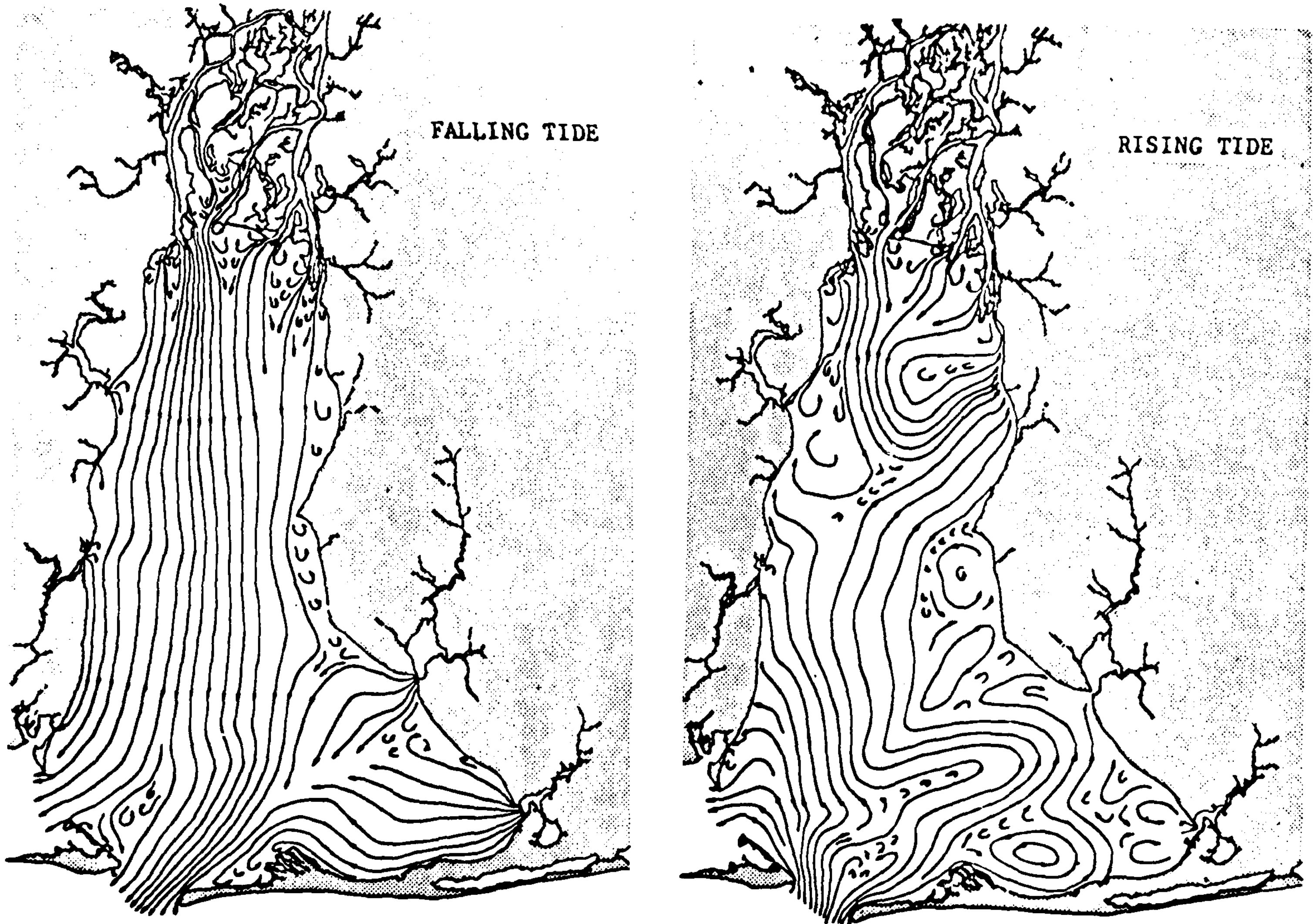
3.131 The western shore of Mobile Bay experiences persistent erosion problems due to a sandy and marshy shoreline and due to flows from upstream rivers. Rates of erosion average less than five feet annually; however, some areas such as Cedar Point erode at a much higher rate (Alabama Coastal Area Board, 1980). The eastern shore of Mobile Bay does not experience significant erosion; in fact, on the average, some accretion has occurred (Alabama Coastal Area Board, 1980).

Hydrology

3.132 Mobile Bay is filling in at an average rate of 1.7 feet per 100 years. The southern half of the bay is filling faster than the northern half, perhaps due to lower water velocities in central and southern portions of the bay. Given the past and present sedimentation rates, Mobile Bay will become gradually smaller and the Mobile River Delta will enlarge southward (Hardin, et al., 1976).

3.133 Circulation within Mobile Bay is affected by fluctuating flows from the Mobile Delta, tidal movements, and wind. Berger and Trawle (1977) indicate that most tidal ranges are between 1.0 and 2.5 ft. The mean tidal range in Mobile Bay is 1.5 ft. in the northern end and 1.2 ft. at its mouth. The extreme range due solely to tidal forces is estimated to be 3.5 ft. (Chermock, 1974). Because of the bay's large surface area and shallow depth the wind can be both an important driving force and a modifying force (Schroeder, 1979).

3.134 Flood tides push Gulf waters into Mobile Bay for approximately six hours; the forces from ebb tides push water back to the Gulf for approximately the same amount of time. Water movements from flood tides deflect to the right as waters move northward into Mobile Bay. These water movements are complicated by irregular shorelines. Austin (as cited in Chermock, 1974) developed tidal flow patterns for falling (ebb) and rising (flood) tides during a period of abnormally low flow Figure 3-12. During ebb tides, water flows straight out of Mobile Bay into the Gulf and



Source: Chermock, 1974.

FIGURE 3-12
TIDAL FLOW PATTERNS IN MOBILE BAY, ALABAMA

Mississippi Sound. Flood tides, however, are more complicated with many small and large eddies. Schroeder's conception of flood tide circulation is not as complicated, with flow taking a more direct route into Mobile Bay from the Gulf and Mississippi Sound (U.S. Army Corps of Engineers, 1979a). Turbulent mixing occurs along the northeast shore of Dauphin Island and southwest shores of Mobile Bay. Information generated by the Mobile Bay model at the Waterways Experiment Station generally agrees with Schroeder's findings. Circulation is also discussed in Chapter 5 for ecologically sensitive locations.

3.135 Of the water leaving Mobile Bay, approximately 85 percent goes through Main Pass to the Gulf of Mexico and approximately 15 percent goes through Pass aux Herons to Mississippi Sound (Chermock, 1974). The South Alabama Regional Planning Commission (1979) reports that tidal flushing rates are estimated to vary between 45 and 54 days. With low to moderate flows from the Mobile River Delta, water movement in the upper one to two miles of Mobile Bay is generally well-mixed. Further south within Mobile Bay, river waters flow over more dense, saline waters. Water movements in lower waters are primarily down the western side of Mobile Bay, due to saline waters concentrating in the northeastern (deeper) portion of the Bay (Schroeder, 1979). Table 3-17 shows effects of high tides during hurricanes on water levels along the Alabama coast. Water levels can rise well over 11 feet due solely to hurricane forces.

Water Quality

3.136 Water quality patterns are extremely variable in Mobile Bay due largely to circulation variations. The range and mean of selected water quality parameters is given in Table 3-18.

3.137 Salinity. Mobile Bay is not as well mixed as Mississippi Sound due largely to freshwater inflows from the Mobile River Delta. Bottom salinity values in Mobile Bay and Mississippi Sound are similar. Much of Mobile Bay has low salinity during periods of high floods. During periods of average or low freshwater flows, bottom salinities of 18 to 20 parts per thousand (grams per liter) move approximately two-thirds of the distance north into Mobile Bay (U.S. Army Corps of Engineers, 1982a). Saline stratification is least significant during periods of largest river flows and most significant when freshwater flows are lowest (U.S. Army Corps of Engineers, 1979a). This stratification is more significant on the eastern side and at the Bay entrance than it is at other locations (Chermock, 1974). The ship channel and its parallel spoil banks create a salt water wedge in Mobile Bay (Chermock, 1974). Effects of tidal oscillations and winds on

TABLE 3-17

HURRICANE TIDE ELEVATIONS AT SELECTED LOCATIONS
ALONG THE GULF OF MEXICO COAST, 1772-1979
(In Feet Above National Geodetic Vertical Datum (NGVD) of 1929)

Date	Pascagoula, Miss.	Bayou La Batre, Ala.	Coden, Ala.	Dauphin Island, Ala.	Mobile, Ala.	Gulf Shores, Ala.	Pensacola Beach, Fla.
September 4, 1772	—	—	—	—	8.2	—	—
August 23, 1852	—	—	—	—	8.0	—	—
October 2, 1893	—	—	—	—	8.4	4.9	—
September 27, 1906	—	—	10.8	—	9.1	11.8	—
July 5, 1916	—	—	10.8	8.0	10.8	11.3	—
August 18, 1969	11.2	8.5	8.3	5.7	7.3	6.0	3.8
September 13, 1979	5.9	9.9	9.0	7.4	8.0	11.4	—

Note: Records furnished by U.S. Army Corps of Engineers, Mobile District.

TABLE 3-18

RANGE AND MEAN OF WATER QUALITY PARAMETERS
MOBILE BAY, ALABAMA

Parameter	Range	Mean
Surface temperature	4.7 - 32.2° C	20.5° C
Bottom temperature	7.1 - 31.9° C	20.3° C
Surface salinity	0.2 - 27.6° C	11.3°/oo
Bottom salinity	0.1 - 34.0° C	17.1°/oo
Surface dissolved oxygen	2.2 - 12.7 ppm	7.7 ppm
Bottom dissolved oxygen	1.4 - 11.9 ppm	7.0 ppm
Surface turbidity	1 - 39 JTU	15.1 JTU
Bottom turbidity	2 - 250 JTU	29.5 JTU
Surface pH	5.89 - 8.44	7.06
Bottom pH	2.30 - 8.32	7.01

Source: Bault (1972)

°C = Degrees centigrade

°/oo = Parts per thousand

ppm = Parts per million

JTU = Jackson turbidity units

salinity levels have not been studied thoroughly. McPhearson (as cited in Chermock, 1974) feels the role of these factors is minor.

3.138 Water temperatures in Mobile Bay range, on the average, from 11°C in January - February to 29°C during July - August. Upper Mobile Bay waters tend to be cooler in the winter and warmer in the summer than waters closer to the Gulf. Average differences between surface and bottom temperatures in Mobile Bay are less than 1° Celsius. From February through June bottom waters are warmer while from August through January surface waters are warmer than bottom waters (Schroeder and Lysinger in Loyacano and Smith, 1979). From November to April surface waters in upper Mobile Bay are cooler than waters nearer Mississippi Sound. Bottom waters show this gradient from September through April (South Alabama Regional Planning Commission, 1979).

3.139 Turbidity and Suspended Solids. Because of the shallowness of the Bay, strong winds frequently resuspend bottom sediments; winds over 15 knots can generate turbidities in excess of 100 Jackson Turbidity Units (JTU) - a measure of the ability of water to transmit light. During calm weather turbidity averages about 22 JTU (U.S. Army Corps of Engineers, 1975a). In the vicinity of the proposed wastewater outfall for the Theodore Industrial Park, suspended particulate matter ranged from 3 mg/l to 18 mg/l during low river flow and light wind conditions. Concentrations near 80 mg/l have been measured during high river flow or wind conditions (U.S. Army Corps of Engineers, 1979a.). Background suspended solids values have been documented to range from 4 to 144 mg/l (May, 1973b) for Mobile Bay (U.S. Army Corps of Engineers, 1980). Suspended solids concentrations cannot be correlated with turbidity measurements, because different suspended particles have different abilities to absorb and scatter light.

3.140 Dissolved Oxygen. A number of factors can affect dissolved oxygen levels in an estuary such as Mobile Bay; these are stratification, biological productivity, and oxygen demand of discharged wastes and sediments. Stratification does occur, productivity levels are high, and wastes are discharged to Mobile Bay. Chermock (1974) reported that shallow bays, creeks and bayous extending upstream of Mobile Bay do experience oxygen depletions due to wasteloads. No indication is given that wasteloads significantly reduce dissolved oxygen concentrations within Mobile Bay itself.

3.141 Dissolved oxygen concentrations during high river flow, measured in April and May, 1976 at three locations across upper Mobile Bay were 6.4, 6.6, and 6.3 mg/l (U.S. Army Corps of Engineers, 1983b). In the middle Bay concentrations were 6.9, 6.7 and 6.8 mg/l. During low freshwater discharge, July and October, 1976, dissolved oxygen concentrations across upper Mobile Bay were 5.1, 6.2, and 6.8 mg/l. For the middle Bay, dissolved oxygen

concentrations were 7.1, 7.7, and 6.8 mg/l. Seven bottom locations sampled during March through May, 1981 by Vittor (as cited in U.S. Army Corps of Engineers, 1983b) in lower Mobile Bay reflected dissolved oxygen concentrations ranging from 4.7 to 9.0 mg/l.

3.142 Bottom waters are said to experience reduced oxygen levels due to salinity stratification especially during summer months when sediments consume the most oxygen (U.S. Army Corps of Engineers, 1979a).

3.143 "Jubilee" conditions occur locally during the summer perhaps due to low dissolved oxygen concentrations. This phenomena has occurred regularly since the 1860s when fish and crustaceans move into shallow waters and remain inactive for several hours. Upwelling of deeper,, oxygen-depleted waters may result in these "jubilees" (U.S. Army Corps of Engineers, 1979a).

3.144 Other Water Quality Constituents. Much of northern Mobile Bay is permanently closed to shellfishing due to high concentrations of fecal coliform bacteria. The sources of these bacteria are municipal wastewater discharges and stormwater runoff from developed lands hugging Mobile Bay. When freshwater flows to Mobile Bay are high, coliform concentrations are also high (U.S. Army Corps of Engineers, 1979a).

3.145 Loadings of nitrogen and phosphorus entering Mobile Bay and concentrations within the Bay vary widely. Presumably, these variations are due to variable freshwater flows and variable water circulation patterns within Mobile Bay. Widely varying estimates of nutrient inputs to Mobile Bay have been made (South Alabama Regional Planning Commission, 1979).

3.146 Little monitoring of heavy metals and organic hydrocarbons has been conducted in Mobile Bay. Chermock (1974) reports that May (1973b) recorded relatively high levels of heavy metals in some sediment samples from Mobile Bay. May (1971, 1973b) has detected pesticides in oyster, sediment and water samples from Mobile Bay. With the exception of DDT, all pesticides detected were present at very low levels (Chermock, 1974). The primary source of heavy metals, with the exception of lead from road runoff, is hypothesized to be "scrubbing" of the atmosphere by precipitation and dustfall (South Alabama Regional Planning Commission, 1979).

Sediments

3.147 Sediment transport is governed by a number of factors; water velocity, sediment particle sizes, particle cohesiveness and water salinity are four important factors, with water velocity being the most significant factor (Isphording and Lamb, 1980). Sediments

which have been deposited for long periods of time are not transported as easily as recently deposited sediments. Tidal currents are usually strong enough to move considerable quantities of suspended materials. Coarse-grained sands are not transported as easily as unconsolidated silts. In estuarine waters, clays can coagulate, or clump together, and thereby settle more rapidly. Sediments in Mobile Bay include all sizes of material ranging from clean sand to clay. Figure 3-13 presents sediment types throughout Mobile Bay for the upper two to three inches of sediment. Wherever sands are deposited as surface sediments, relatively strong currents tend to predominate, whereas weaker currents predominate in locations wherever clays are deposited as sediments at the sediment-water interface.

3.148 Approximately 4.7 to 5.5 million tons of suspended sediments is reported to be carried by the Mobile River Delta to Mobile Bay each year (U.S. Army Corps of Engineers, 1979a and Raney, 1982). In addition, from 1970 to 1977 an average of 6.4 million cubic feet of sediment was dredged each year from navigation channels, primarily between the city of Mobile and Main Pass. According to Raney (1982), sediment dredged from the main channel is placed on both sides of the channel within a total width adjacent to the channel of 2,000 feet. However, the U.S. Army Corps of Engineers (Personal communication, 1984) indicates that dredged spoil is placed at a minimum distance of 2,500 feet from the edge of a dredged channel. Approximately 30 percent of the average load of suspended sediments is carried through Mobile Bay to the Gulf of Mexico. Transport of sediments from within Mobile Bay itself has not been quantified.

3.149 Clay content of most sediment samples is at least 50 percent. The principal clay minerals in samples are montmorillonite and kaolinite (U.S. Army Corps of Engineers, 1979a). Clays and sands constitute most of the sediment; percentages of silt content are generally low (Isphording and Lamb, 1980). The high percentage of montmorillonite throughout Mobile Bay indicates that sediments in the Bay have a high potential to attract contaminants.

Aquatic Ecosystems

3.150 The major components of the aquatic ecosystem of Mobile Bay are plankton, submersed aquatic vegetation, benthic invertebrates and mobile shellfish and finfishes. The components have been studied to varying extents.

3.151 Phytoplankton. Phytoplankton are microscopic single-celled plants that live freely in the water. They often serve as ar important food source for many estuarine animals.

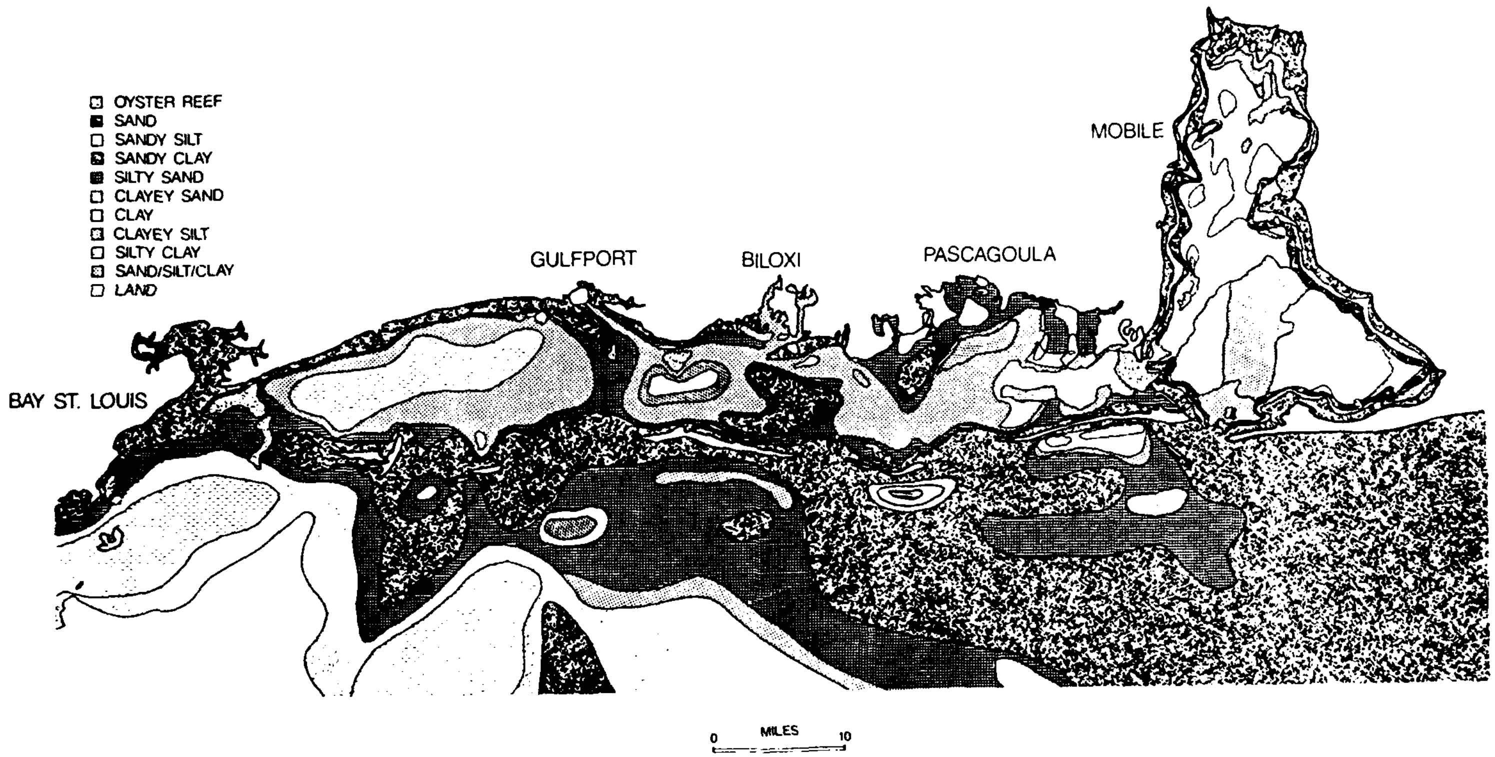


FIGURE 3-13
SEDIMENTS OF MOBILE BAY, MISSISSIPPI SOUND AND THE NEARSHORE GULF OF MEXICO

Thirteen species of blue-green algae and 24 species of green algae have been identified from Mobile Bay (U.S. Army Corps of Engineers, 1977). No data are available on their abundance or distribution within the Bay or seasonal pattern of occurrence.

3.152 Submersed Aquatic Vegetation. Submersed aquatic vegetation consist of monocot plants rooted in the sediment. Species occurring in the higher salinity areas are often called seagrasses. Aquatic vegetation and the associated algal species are highly productive. They provide principal food for many waterfowl species and some fish. Seagrasses provide important habitat for breeding and refuge to many estuarine species, especially juvenile shrimp, crabs and fish; some species may be dependant on grass beds for part of their life cycle (Mann, 1973; Bittaker and Iverson, 1976; Stevenson and Confer, 1978; Fry and Parker, 1979; Borom, 1979; Sheridan and Livingston, 1983).

3.153 The current distribution of submersed aquatic vegetation in Mobile Bay is shown on Figure 3-14 (end of chapter). Although sufficient supporting data are lacking, the area currently occuppied by grass beds in the bay is thought to be considerably less than that occupied about 1960 (Borom, 1979; Stout and Lelong, 1981).

3.154 Zooplankton. Zooplankton are important food items for many larvae and some adult fish and as processors of organic matter occurring as phytoplankton and detritus in the water column. Few data are available on the zooplankton of Mobile Bay (Shipp, L.P., 1979). Samples of surface waters at passes into Mobile Bay found the copepod *Acartia tonsa* to be abundant (Swingle, 1971). Ctenophora (jellyfish-like animals), a major predator of zooplankton, were also abundant. These samples may only be typical of the higher salinity southern bay. A different assemblage of species may be present in lower salinity areas and during high river flow periods.

3.155 Benthic Macroinvertebrate Animals. Macroinvertebrate animals living in the sediments obtain organic matter by filtering it from the water (filter feeders) or from the sediment itself (deposit feeders). They also are important as food for larger predator species. Some quantitative data are available for several sites within Mobile Bay, but most data are from one-time only sample programs. Only 3 locations have been sampled on a seasonal basis: D'Olive Bay at the northern end of Mobile Bay, the mid-bay area in the vicinity of the Theodore Ship Channel, and at the mouth of the bay within 1 mile of Mobil Oil drilling site 1-76 in leased block 76.

3.156 Seasonal sampling in leased block 76 at the mouth of Mobile Bay revealed three benthic community types (Tech Con, Inc., 1980), based on water depth, salinity and sediment differences. In

shallow water sand substrates low in silt and clay, dominant species were the cephalochordate Branchiostoma caribaeum, and the worms Paraprionasyllis longicirrata and Polygordius sp. Seasonally abundant were the worm Mediomastus californiensis, amphipod Lepidactylus sp. and mollusc Mulinia lateralis. In medium to coarse sand with moderate amounts of silt and clay the dominant species were the worms Magelona cf. cincta and Malacoceros vanderhorsti. Other worms (Mediomastus californiensis, Myriochele oculata and Polygordius sp.) were seasonally important. Muddy, fine sand-silt-clay substrates in deeper water were dominated by worms (Coseura soyeri, Paraprionospio pinnata, Magelona pacifica, Neanthes micromma and Micropholis atra). Other worms (Owenia fusiformis, Myriochele oculata) and a mollusc (Mulinia lateralis) occurred in large numbers seasonally.

3.157 Two other limited studies have been carried out in southern Mobile Bay (summarized in Vittor, 1979; U.S. Army Corps of Engineers, 1983b). Polycheate worms were found to be dominant in one study. Another set of samples also found worms to be dominant. These included Mediomastus californiensis, Streblospio benedicti and Paramphinome pulchella. The community was more diverse near the Dauphin Island bridge.

3.158 Spring samples have been taken in south central Mobile Bay (Barry A. Vittor and Associates, Inc. 1982). Numerically dominant benthic organisms were the worms Leitoscoloplos sp. and Mediomastus spp.; bivalue mollusc Mulinia lateralis; gastropod mollusc Haminoea succinea and Utriculastra canaliculata; and the cumacean crustacean Oxyurostylis smithi. This community has been called the Lower Mobile Bay Mud Community (Figure 3-15, end of chapter).

3.159 Seasonal sampling in west central Mobile Bay in the vicinity of the Theodore Ship Channel found 78 species of macroinvertebrates of which 38 were polychaete worms. Dominant worms were Mediomastus californiensis, Polydora ligni, Streblospio benedicti, Neanthes succinea and Parandalia americana. The bivalve molluscs Rangia cuneata and Tellina lineata and the amphipod Melita nitida were also important. Polycheate diversity varied with season (Vittor, 1979).

3.160 A study in D'Olive Bay in the lower salinity northern Mobile Bay found only 19 benthic species. The polychaete worm Laeonereis culveri was very common. The clam Rangea cuneata and amphipods were abundant at some locations (Vittor, 1979).

3.161 Oyster Reefs. Natural oyster reefs occupy about 3000 acres in central and southern Mobile Bay (Figure 3-14, end of

chapter) (May, 1971). Oyster densities are sufficient for commercial harvesting (see Commercial Fishery section) only on the reefs in the Cedar Point vicinity. Other reefs contribute to production of spat.

3.162 Shrimp. Fifteen species of shrimp are found in Mobile Bay (Heath, 1979). The brown shrimp (*Penaeus aztecus*), white shrimp (*Penaeus setiferus*) and pink shrimp (*Penaeus duorarum*) are an important part of the commercial fishery of the region (see section on commercial fisheries). These 3 species utilize coastal estuarine waters such as Mobile Bay as nursery areas for the growth and maturation of the younger life stages. Spawning of adults occurs during the winter in the high salinity and more stable environment of the coastal Gulf of Mexico waters. The free-floating young larval stages are eventually carried into the lower salinity estuarine areas, brown shrimp beginning in February with peak movement in March and April, white and pink shrimp from May through October or November. Upon entering the estuary, the larvae become bottom dwellers with white shrimp generally seeking out lower salinity areas than brown or pink shrimp. Growth is rapid during the warm months, but actual survival and growth rate is strongly influenced by environmental conditions experienced during this time. As the juvenile shrimp get larger they move to deeper parts of the bay and eventually move offshore into the coastal Gulf waters.

3.163 Blue Crabs. Blue crabs, another commercially important species, are also dependent on both the estuarine and Gulf areas for their complete life cycle (Chermock, 1974; Tatum, 1979). Mating of adult crabs occurs in the low salinity waters of Mobile Bay from March through November, after which the females migrate to the high salinity Gulf waters, where spawning occurs. The planktonic larvae are eventually carried into the bay, where they mature.

3.164 Finfish. In Mobile Bay 162 species of fish have been collected (Swingle, 1971). Ninety-one are included in commercial harvests. As with invertebrate species, many of these fishes utilize the estuaries as a nursery area during their younger life stages and move into the deeper waters of the Gulf as they mature and for spawning (Chermock, 1974; Swingle, 1971). Some species have distinct seasonal movement patterns within the bay (Shipp, R.L., 1979). The dominant species in Mobile Bay are the bay anchovy, Atlantic croaker, spot, menhaden, striped mullet, tidewater silverside, and sea catfish. Other important species include the white and spotted sea trout, kingfish, and several species of flounder. The most important commercial species are the croaker, flounder, mullet, and white and spotted sea trout. The spotted sea trout is the most important recreational fishery species.

3.165 Waterfowl. Waterfowl overwintering in the Mobile Bay area are found mainly in the shallow northern portion of the bay near the Battleship Parkway, which has extensive beds of submersed aquatic plants utilized as food. Waterfowl are discussed more extensively in the section on the Mobile Delta.

3.166 Wading Birds and Shorebirds. Wading birds and shorebirds are common permanent and seasonal residents of the Mobile Bay area (U.S. Army Corps of Engineers, 1983b). Common wading birds include the great blue heron, little blue heron, Louisiana heron, green heron, snowy egret, cattle egret and black-crowned heron. Thirteen wading birds nest on the coastal islands and in marshes and wetlands of coastal Alabama and Mississippi. Common shorebirds are the royal tern, least tern, common tern, Forster's tern, Caspian tern and laughing gull. Shorebirds require sandy areas for nesting. Shorebird and wading bird nesting colonies are shown on Figure 3-14 (end of chapter).

Wetland Ecosystems

3.167 Wetland ecosystems are important producers of organic matter for the detritus-based food web of the estuary. Wetlands also serve as habitat for young and juveniles of many estuarine species.

3.168 Wetlands in Mobile Bay are found mostly in the tributaries (Figure 3-14, end of chapter). The types of marsh found vary from salt marsh through brackish marsh to freshwater marsh (Geological Survey of Alabama, 1976; Stout, 1979; Stout and Lelong, 1981). Vegetation species typical of each type are given in Table 3-19.

Upland Ecosystems Adjacent to Mobile Bay

3.169 The original upland ecosystems adjacent to Mobile Bay were the longleaf pine-oak community on drier sites and pine savannah community on wetter sites. These communities have been removed or altered throughout much of the area. Currently, much of the area is a mixture of agriculture; pasture; rural and urban residential and industrial uses; and pine-oak and pine savannah woodlands.

Threatened and Endangered Species

3.170 The U.S. Department of the Interior maintains a list of animal and plant species that are threatened and endangered in the United States. Scientists from the state of Alabama have also compiled a list of species that are considered threatened and endangered in Alabama (Boschung, 1976). The list is unofficial, however.

TABLE 3-19

DOMINANT VEGETATION OF THE WETLAND TYPES IN MOBILE BAY

Wetland Type	Dominant Vegetation: Common Name	Dominant Vegetation: Scientific Name
Salt Marsh	Saltmarsh Cordgrass	*Spartina alterniflora*
	Black Needlerush	*Juncus roemerianus*
	Salt Grass	*Distichlis spicata*
	Saltmeadow Cordgrass	*Spartina patens*
Brackish Marsh I[a]	Black Needlerush	*Juncus roemerianus*
	Saltmeadow Cordgrass	*Spartina cynosuroides*
		Spartina patens
Brackish Marsh II[a]	Black Needlerush	*Juncus roemerianus*
	Saltmeadow Cordgrass	*Spartina patens*
	Sawgrass	*Cladium jamaicense*
	Roseau Cane	*Phragmites australis*
	Duck Potato	*Sagittaria falcata*
Fresh Marshes	Alligator Grass	*Alternanthera philo-xeroides*
		Sagittaria falcatta
	Wild Rice	*Zizania aquatica*
	Cutgrass	*Zizaniopsis miliacea*
	Giant Bullwhip	*Scirpus validus*
	Cattails	*Typha spp.*
	Phragmites	*Phragmites australis*

[a]Brackish Marsh I occurs in more saline environment than Brackish Marsh II.

Source: Stout, 1979.

Animals from these lists that could occur in the Mobile Bay vicinity are given in Table 3-20. The list of plants would be the same as that given for the Mobile Delta vicinity.

Mississippi Sound and Adjacent Areas

3.171 Mississippi Sound extends about 80 miles from the Dauphin Island bridge in Alabama in the east to Lake Borgne at the Louisiana-Mississippi line in the west. The sound is separated from the Gulf of Mexico by several low-lying barrier islands. Depths are shallow, averaging about 13 feet deep. Navigation channels crossing the sound include the Intracoastal Waterway and the Pascagoula-Bayou Cassotte, Biloxi and Gulfport Ship Channels.

Bathymetry

3.172 Approximately 21 percent of the surface area at mean high water is less than three feet deep, while approximately six percent of the surface area is over 18 feet deep (U.S. Army Corps of Engineers, 1978a). Figure 3-16 shows bathymetry.

Hydrology

3.173 Mississippi Sound, in a hydrologic sense, has three distinct zones. The first is an eastern zone affected by freshwater inputs from the Pascagoula River and Mobile Bay, the second is a western zone affected by freshwater inputs from the Pearl and Mississippi Rivers, and the third is a central zone between the eastern and western zones. Freshwater inputs to Mississippi Sound, in addition to waters from Mobile Bay, are summarized in Table 3-21. Monthly variations in freshwater flows to Mississippi Sound are most probably similar to variations observed for Mobile Bay. In general, fewer efforts have been made to study Mississippi Sound than have been made for Mobile Bay; in particular the Mississippi portion of the Sound has not been studied as thoroughly.

3.174 The Mississippi Sound has one tidal cycle in a 24.8-hour period. High or low tides do not occur at the same time within Mississippi Sound but rather have as much as a six hour phase shift (U.S. Army Corps of Engineers, 1983b). Tides, ranging from 1.5 to 1.8 feet, occur first at Horn Island Pass, one to three hours later at Mobile Bay, Dog Keys Pass, Ship Island Cut and Ship Island Pass, and four to six hours later at Cat Island Channel.

3.175 Currents caused by the tide bifurcate at Horn Island Pass and split Mississippi Sound into two distinct areas. Between Horn Island Pass and Lake Borgne, currents flow in a westerly direction during flood tides and an easterly direction during ebb

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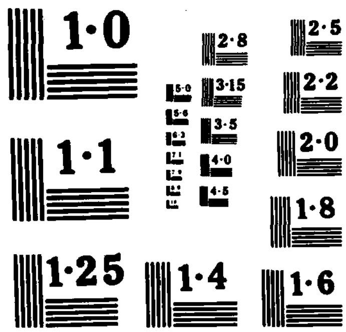


NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

TABLE 3-20

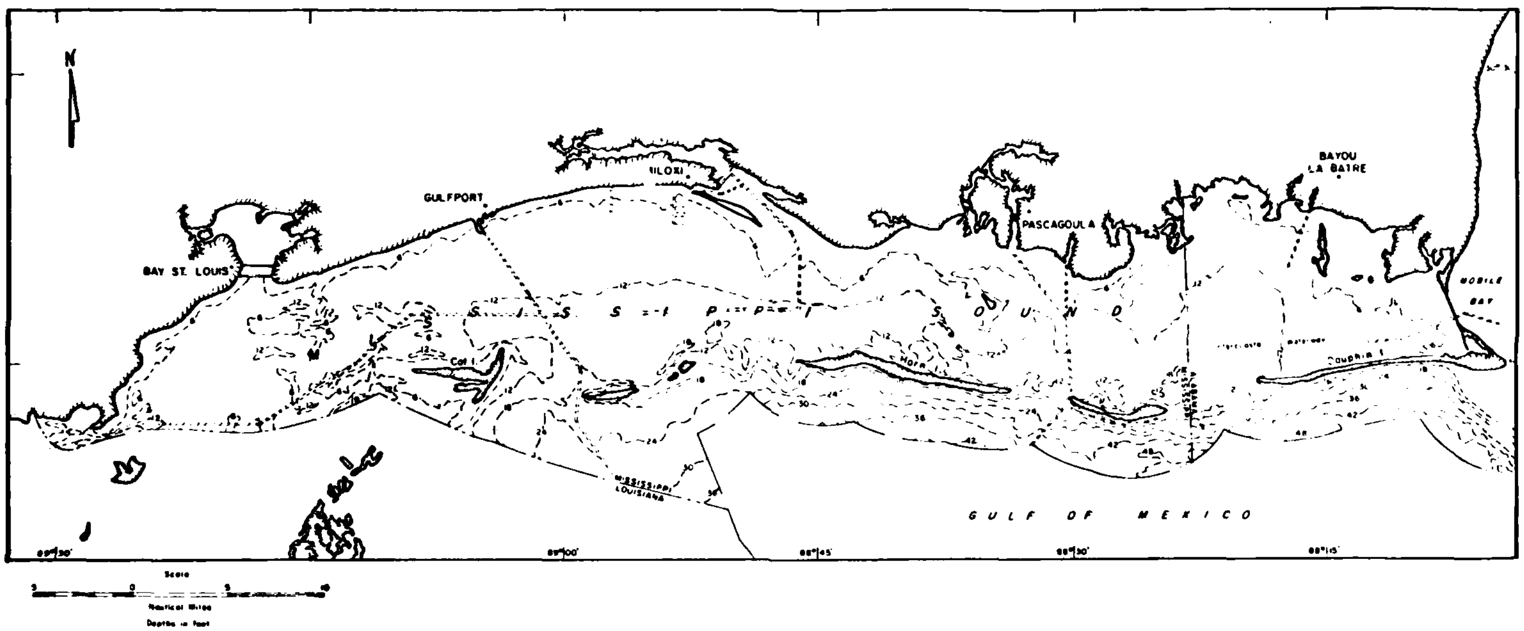
ENDANGERED AND THREATENED ANIMALS THAT COULD OCCUR IN THE MOBILE BAY VICINITY

Common Name	Scientific Name	Status Alabama	Status Federal
MAMMALS			
Alabama Gulf Beach Mouse	Peromyscus polionotus ammomatus	E	
Florida Black Bear	Ursus americanus floridanus	E	
Florida Panther	Felis concolor coryi	E	E
Manatee	Trichechus manatus		E
BIRDS			
Bald Eagle	Haliaeetus leucocephalus	E	E
Red-Cockaded Woodpecker	Dendrocopos borealis	E	E
Peregrin Falcon	Falco pereginus	E	E
Snowy Plover	Charadrius alexandrinus	E	
Brown Pelican	Pelecanus occidentalis	E	E
Osprey	Pandion haliaetus	E	
Reddish Egret	Dichromanassa rufescens	T	
Mottled Duck	Anas fulvigula	T	
AMPHIBIANS AND REPTILES			
Gopher Tortoise	Gopherus polyphemus	T	
Alabama Red-Bellied Turtle	Pseudemys alabamensis	T	
Eastern Indigo Snake	Drymarchon corais couperi	E	T
Black Pine Snake	Pitophis melanoleucus lodingi	E	
American Alligator	Alligator mississippiensis	E	E
Flatwoods Salamander	Ambystoma cingulatum	E	
Dusky Gopher Frog	Rana areolata sevosa	T	
FISH			
Alabama Shovelnose Sturgeon	Scaphirhyncus sp.	E	
Atlantic Sturgeon	Acipenser oxyrhynchus	T	

E=Endangered
T=Threatened

Alabama list is unofficial.

Source: U.S. Army Corps of Engineers, 1981a; 1983b.



Source: U.S. Geological Survey, 1980.

FIGURE 3-16
BATHYMETRY OF MISSISSIPPI SOUND

TABLE 3-21

AVERAGE FRESH WATER FLOWS ENTERING MISSISSIPPI SOUND

River	Average Flow, cfs	Discharge Location
Pascagoula	13,400	Mississippi Sound at Pascagoula
Biloxi	490	Biloxi Bay
Tchoutacabouffa	440	Biloxi Bay
Jourdan	1,540	St. Louis Bay
Wolf	710	St. Louis Bay
Pearl	11,600	Lake Borgne
Tidal Bayous	Not known	Scattered
Rainfall and Direct Runoff	Not known/variable	Scattered
TOTAL	28,000(+)	

Source: Eleuterius, 1976
cfs - cubic feet per second

tide. Between Horn Island Pass and Mobile Bay, currents flow in an easterly direction during flood tides and a westerly direction during ebb tides. Velocities range from zero to three feet per second (fps) in the barrier island passes and 0 to 0.8 fps in Mississippi Sound itself. West of Biloxi and east of Petit Bois Pass are the high velocity areas and the low velocity area is near Pascagoula (U.S. Army Corps of Engineers, 1983b).

3.176 The effect of east-west winds or circulation are significant and tend to shift the bifurcation eastward or westward, depending on the wind direction. Winds from the north and south, as well as freshwater inflows, have a minimal effect on circulation patterns induced by tides and east-west winds. Since 1974, water level surges due to hurricanes have been recorded three times to be greater than 10 ft. with the highest being approximately 20 ft (U.S. Army Corps of Engineers, 1983b).

Water Quality

3.177 A few small-scale water quality surveys have been conducted within a portion of Mississippi Sound or within freshwater tributaries. VTN Engineers and Planners (1974) gives a brief synopsis of water and sediment quality for a portion of Mississippi Sound adjacent to Pacagoula, Mississippi.

3.178 Salinity and Temperature. Salinity levels vary from approximately 33 parts per thousand near the barrier islands to freshwater conditions near the mouths of rivers. Salinity levels vary widely from month to month as well. Eleuterius (1976b, 1977) presents salinity data reported in the literature for Mississippi Sound. General conclusions from his work are as follows:

- Salinities are highest in the summer and fall (when freshwater flows are lowest) and lowest in the winter and spring.
- Salinities are highest nearest the Gulf of Mexico, particularly in eastern portions of the Mississippi Sound further from the Mississippi River Delta.
- Salinities are higher in deep channels and lower at the water surface.

3.179 Bault (1972) reports average surface and bottom salinity values for all of Mississippi Sound during 1968-1969 of 23.9 and 25.9 parts per thousand respectively. Such a small difference in surface and bottom salinities indicate waters are fairly well mixed on the average.

3.180 The U.S. Army Corps of Engineers (1978a) also indicates that waters of Mississippi Sound are fairly well mixed, based on water temperature measurements. Stratification based on water temperature is more pronounced during July - August than during January - February based on these results from Christmas (1973: as cited in U.S. Army Corps of Engineers, 1978a).

3.181 Turbidity. Results from Bault (1972) indicate turbidity for April 1968 through March 1969 averaged 23 Jackson Turbidity Units (JTUs), compared to 22 JTUs in Mobile Bay. Average turbidity values were 16 JTUs near the water surface and 30 JTUs in bottom waters. The only other data for turbidity and suspended solids discovered in literature review efforts are results of one-time grab sampling efforts.

3.182 Other Water Quality Constituents. Measurement results for pH, dissolved oxygen, nutrients (nitrogen and phosphorus), coliform bacteria and metals are available for Mississippi Sound in varying degrees. The pH values more closely approach levels for marine waters than pH values for Mobile Bay and more inland waters. Bault (1972) gives average pH values of 7.4 - 7.5 for surface and bottom waters. Little dissolved oxygen and metal data are available. Eleuterius (1976) presents distributions of average and maximum nitrite, nitrate, orthophosphate, and total phosphate for the entire Mississippi Sound; higher nitrogen levels are associated with freshwater inflows. Fecal coliform bacteria levels are reported in the Mississippi Air and Water Pollution Control Commission (undated) for nearshore areas along recreational beaches.

Sediments

3.183 As with hydrology and water quality, the descriptions of the eastern portion of Mississippi Sound are based on more data than descriptions of the western portion. Upper sediments dominated by sands, such as areas near passes, generally indicate greater water velocities than do upper sediments dominated by silts or clays. Sediments as mapped in U.S. Army Corps of Engineers (1983b) are shown in Figure 3-13.

3.184 Isphording and Lamb (1980) conducted recent analyses of sediments in eastern Mississippi Sound. Montmorillonites and illites which can absorb and release large quantities of metals and organic compounds constitute nearly 80 percent of the sediment analyzed. Sands are concentrated in a band along the northern side of Dauphin Island and in the pass between Dauphin Island and Petit Bois Island. More silt has been observed in eastern Mississippi Sound than in Mobile Bay. Much of the sampled sediment is a mixture of clay, silt and sand which can vary due to storm effects.

3.185 Isphording and Lamb (1980) suspect that much of the sediment within Mississippi Sound has been transported eastward from the Mississippi River Delta rather than westward from the Mobile River Delta. Conversely, the net westward movement of water in Mississippi Sound is sufficient to induce sediment drift.

Aquatic Ecosystems

3.186 The components of the aquatic ecosystem of Mississippi Sound are the plankton, submersed aquatic vegetation, benthic invertebrates and mobile shellfish and fish. These components have been studied to varying extents.

3.187 Submersed Aquatic Vegetation. Seagrass beds occur along the barrier islands (Figure 3-14, end of chapter) (Eleuterius,1973b; U.S. Army Corps of Engineers, 1983b). The main species are shoal grass (*Halodule wrightii*), turtle grass (*Thalassia testudinum*), manatee grass (*Cymodocea manatorum*), widgeon grass (*Ruppia maritima*) and *Halophila engelmanni*. Red and brown algae are often associated with the grassbeds.

3.188 Zooplankton. Copepods are the dominant zooplankter, with *Acartia tonsa* the most common species (Perry and Christmas, 1973). Plankton volume was greatest in the summer because of the occurrance of larvae of benthic invertebrates. The seasonal occurrance of the predatious ctenophore *Mnemiopsis mccradyi* greatly reduced zooplankton numbers. Maximum concentrations and greatest species diversity of zooplankton occurs in the southern part of the sound where salinities are greatest.

3.189 Benthic Macroinvertebrate Animals. Three benthic habitat types have been identified in Mississippi Sound (Barry A. Vittor and Associates, Inc., 1982). These are the shallow coastal margin mud habitat, deep open sound muddy sand habitat and the tidal pass/shallow sound clean sand habitat (Figure 3-15, end of chapter). The numerically dominant species in each habitat are given in Table 3-22. In general, polychaete worms characterized the muddier habitats. Seasonal variations were not large for most species. Biomass was about 15 percent greater in the spring than in the fall. Number of species collected increased slightly from fall to spring, reflecting the spring recruitment of many of the species.

3.190 Oyster Reefs. Productive oyster reefs in Mississippi Sound occupy about 5000 acres (all reef area in the vicinity of the Dauphin Island bridge is included in the Mobile Bay total) (Mississippi Department of Wildlife Conservation, Bureau of Marine Resources, 1982). Most of this area is in the western portion of the sound (Figure 3-14, end of chapter). These reefs support an

TABLE 3-22

NUMERICALLY DOMINANT BENTHIC ANIMALS BY HABITAT TYPE IN MISSISSIPPI SOUND

Species	Type of Organism	
	SHALLOW COASTAL MARGIN MUD HABITAT	
Myriochele oculata	Polychaete worm	Organism Density
Owenia fusiformis	Polychaete worm	(individ./m^2)
Balanoglossus cf. *aurantiacus*	Hemichordate	3915
Linopherus-Paramphinome complex	Polycheate worms	
Mediomastus spp.	Polychaete worms	
Leitoscoloplos sp.	Polychaete worm	Biomass (g/m^2)
Paraprionospio pinnata	Polychaete worm	11.53
Sigambra tentaculata	Polychaete worm	
	DEEP OPEN SOUND MUDDY SAND HABITAT	
Myriochele oculata	Polychaete worm	Organism Density
Owenia fusiformis	Polychaete worm	(individ./m^2)
Mediomastus spp.	Polychaete worm	12,470
Hemipholis elongata	Echinoderm	
Micropholis atra	Echinoderm	
Paraprionospio pinnata	Polychaete worm	Biomass (g/m^2)
Cossura soyeri	Polychaete worm	44.18
Linopherus-Paramphinome complex	Polychaete worm	
Rhynchocoela sp.	Nemertean worm	
	TIDAL PASS/SHALLOW SOUND CLEAN SAND HABITAT	
Tidal Pass Stations		
Polygordius spp.	Polychaete worm	Organism Density
Brachiostoma caribaeum	Lancet	(individ./m^2)
Mediomastus spp.	Polychaete worm	7,399
Crassinella lunulata	Bivalve mollusc	
Acanthohaustorius sp.	Crustacean	Biomass (g/m^2)
Spiophanes bombyx	Polychaete worm	37.59
Armandia maculata	Polychaete worm	
Shallow Sound Stations		
Gemma gemma	Bivalve mollusc	Organism Density
Paraonis cf. *flugens*	Polychaete worm	(individ./m^2)
Acanthohaustorius sp.	Crustacean	12,970
Lepidactylus sp.	Crustacean	
		Biomass (g/m^2)
		16.42

Source: Barry A. Vittor and Associates, Inc., 1982.

extensive commercial oyster fishery (see section on commercial fisheries).

3.191 Shrimp. Shrimp are common in Mississippi Sound and adjacent tributary bays and bayous. The brown, white and pink shrimp are harvested commercially (see commercial fishery section). These shrimp spawn offshore and the larvae are carried into the sound, where they mature (see Mobile Bay section).

3.192 Blue Crabs. The blue crab is caught commercially in Mississippi Sound. Spawning is in high salinity areas near the barrier islands in the winter. Larvae and young crabs are found throughout the sound (Mississippi Department of Wildlife Conservation, Bureau of Marine Resources, 1982).

3.193 Finfish. A list of 244 fish species collected in Mississippi Sound has been compiled. Of these, 113 were collected in monthly trawl samples from April 1968 through March 1969. In this study, 6 species comprised about 94 percent of the total numbers of fish captured (Christmas and Waller, 1973):

Species	Percent of Total
Bay anchovy (Anchoa mitchilli)	70.53
Menhaden (Brevoortia patronus)	10.73
Atlantic croaker (Micropogon undulatus)	6.63
Spot (Leiostomus xanthurus)	2.27
Butterfish (Peprilus burti)	2.12
Sand seatrout (Cynoscion arenarius)	1.56

3.194 The finfish population supports an extensive commercial and sport fishery (see sections on commercial fisheries and tourism and outdoor recreation).

3.195 Waterfowl. Compared to the Mobile Delta, Mississippi Sound is not extensively used for overwintering by waterfowl. Midwinter counts are given in Table 3-23.

3.196 Shorebirds and Wading Birds. Shorebirds and wading birds are common permanent and seasonal residents in the Mississippi Sound area (see Mobile Bay section). Locations of nesting colonies are shown on Figure 3-14 (end of chapter).

3.197 Sea Turtles. Five species of sea turtles are known to occur in the vicinity of the Gulf barrier islands: Loggerhead, Green, Leatherback, Atlantic Ridley and Hawksbill (U.S. Army Corps of Engineers, 1983b). These species are on the federal threatened and endangered species list (see below). It is not known if sea

TABLE 3-23

MIDWINTER DUCK COUNTS FOR MISSISSIPPI SOUND

Year	Ducks		Coots
1969	3,300		1,100
1970	800		--
1971	500		--
1972	1,300		500
1973	3,400		800
1974	7,500		--
1975		No survey	
1976	400		700
1977		No survey	
1978	1,500		100
1979		No survey	
1980		No survey	
1981	5,100		--
1982		No survey	
1983	300		--

Source: *U.S. Fish and Wildlife Service,*
Starkville, MS.

turtles still nest on the Mississippi barrier islands. The extensive seagrass beds on the sound side of these islands may be used as feeding areas (Mississippi Department of Wildlife Conservation, Bureau of Marine Resources, 1982).

Wetland Ecosystems

3.198 Wetlands fringing Mississippi Sound occur mainly in the eastern portion from the Dauphin Island bridge to the Pascagoula River and in the extreme western end of the sound between Waveland and the Pearl River (Figure 3-14, end of chapter). Other wetlands occur in the sound tributaries of Biloxi Bay and St. Louis Bay (Eleuterius, 1973a; Stout and Lelong, 1981; Mississippi Department of Wildlife Conservation, Bureau of Marine Resources, 1982).

3.199 Wetlands currently occupy about 77,000 acres around Mississippi Sound (Eleuterius, 1973a; Stout and Lelong, 1981). As of 1973, about 10,000 acres had been lost to human activities (Eleuterius, 1973a). Additional wetland losses have occured since then.

3.200 Wetlands fringing the sound are mainly saline marshes dominated by *Juncus roemerianus* with *Spartina alterniflora* borders. The brackish water species *Spartina patens*, *S. cynosuroides* and *Scirpus olneyi* occur amongst the *Juncus* where salinities are lower. Salt flats occur occassionally within the saline marsh and are characterized by succulent plants such as *Salicornia bigelovi*, *Suaeda linearis* and *Batis maritimus* (Eleuterius, 1973a). In the eastern sound wet pinelands and bay forests occur on the upland side of the fringing marshes (Stout and Lelong, 1981).

3.201 Within the tributary systems wetlands grade from saline, to brackish, to intermediate to freshwater marshes as salinity decreases. In brackish marsh, *Spartina cynosuroids* and *S. patens* are abundant with *Juncus roemerianus*. *S. alterniflora* is less abundant. In intermediate marshes, *Phragmites communis* and *Scirpus validus* are common. *Juncus* is still present but *Spartina* no larger occurs. Freshwater marshes are characterized by many species, with *Eleocharis cellulosa* being common (Eleuterius, 1973a).

Upland Ecosystem Adjacent to Mississippi Sound

3.202 The original upland ecosystems on the mainland adjacent to Mississippi Sound were the longleaf pine-oaks community on drier sites and pine savannah community on wetter sites. These communities have been removed or altered throughout much of the area. Currently, much of the area is a mixture of agriculture, pasture, rural and urban residences, commercial and industrial uses and pine-oak and pine savannah woodlands.

3.203 Vegetation of the barrier islands is typical of such coastal habitats (summarized in Mississippi Department of Wildlife Conservation, Bureau of Marine Resources, 1982). Along the Gulf of Mexico is the high energy sandy beach. On the dune system along the beaches are sea oats (Uniola paniculata), sea bite (Suaeda linearis), sea lavender (Limonium carolinianum) and fimbristylis (Fimbrystylis castanea). Woodlands occur is some areas. Species found include slash pine (Pinus elliottii), sand pine (Pinus clausa), longleaf pine (Pinus palustris), rosemary (Ceratiola eriocoides), scrub oak (Quercus sp.), live oak (Q. virginiana), southern magnolia (Magnolia grandifolia), red cedar (Juniperus virginiana) and saw palmetto (Serenoa repens). Freshwater and saline marshes also occur on the sound side of the island.

3.204 The barrier islands are important habitat for many birds and sea turtles, which are part of the estuarine and oceanic foodwebs (also see section on rare and endangered species). Colonial seabird nesting activity occurs between April and August on the barrier islands and dredged material islands. Wading birds, such as herons, egrets and ibis, are most abundant from February through July. Waterfowl utilize the wetland areas as well as the adjacent beds of submersed aquatic vegetation.

Threatened and Endangered Species

3.205 The U.S. Department of the Interior maintains a list of animal and plant species that are threatened and endangered in the United States. The states of Alabama (Boschung, 1976) and Mississippi have also compiled lists of species that are considered threatened and endangered in those states. The Alabama list is unofficial. Plants and animals from these lists that could occur in the Mississippi Sound vicinity are given in Tables 3-24 and 3-25.

State Waters of the Gulf of Mexico

3.206 State waters of the Gulf of Mexico extend from the beach offshore to 3 miles. Depths vary from the intertidal surf along the beaches to about 50 feet at some places at the 3 mile limit.

Bathymetry

3.207 Bathymetry of the state waters of the Gulf of Mexico is shown in Figures 3-11 and 3-16. Tidal ranges for Dauphin Island average about 1.2 feet while the range at Ship Island is 1.7 feet.

TABLE 3-24

ENDANGERED AND THREATENED ANIMALS THAT COULD OCCUR IN THE MISSISSIPPI SOUND VICINITY

Common Name	Scientific Name	Status State	Status Federal
MAMMALS			
Florida Black Bear	Ursus americanus floridanus	E(AL,MS)	
Florida Panther	Felis concolor coryi	E(AL,MS)	E
Manatee	Trichechus manatus	E(MS)	E
BIRDS			
Bald Eagle	Haliaeetus leucocephalus	E(AL,MS)	E
Red-Cockaded Woodpecker	Picoides borealis	E(AL,MS)	E
Peregrin Falcon	Falco peregrinus	E(AL,MS)	E
Snowy Plover	Charadrius alexandrinus	E(AL)	
Brown Pelican	Pelecanus occidentalis	E(AL,MS)	E
Osprey	Pandion haliaetus	E(AL)	
Reddish Egret	Dichromanassa rufescens	T(AL)	
Mottled Duck	Anas fulvigula	T(AL)	
Mississippi Sand Hill Crane	Grus canadensis pulla	E(MS)	E
AMPHIBIANS AND REPTILES			
Gopher Tortoise	Gopherus polyphemus	T(AL,MS)	
Eastern Indigo Snake	Drymarchon corais couperi	E(AL,MS)	T
Black Pine Snake	Pitophis melanoleucus lodingi	E(AL,MS)	
Rainbow Snake	Farancia erythrogramma	E(MS)	
Southern Hognose Snake	Neterodon simus	E(MS)	
American Alligator	Alligator mississippiensis	E(AL,MS)	E
Yellow-Blotched Sawback Turtle	Graptemys flavimaculata	T(MS)	
Ringed Sawback Turtle	Graptemys oculifera	T(MS)	
Flatwoods Salamander	Ambystoma cingulatum	E(AL)	
Dusky Gopher Frog	Rana areolata sevosa	T(AL)	
Atlantic Hawksbill Turtle	Eretmochelys imbricata imbricata	E(AL,MS)	E
Atlantic Loggerhead Turtle	Caretta caretta caretta	E(AL,MS)	T
Atlantic Ridley Turtle	Lepidochelys kempi	E(AL,MS)	E
Leatherback Sea Turtle	Dermochelys coriacea	E(MS)	E
Green Sea Turtle	Chelonia mydas	E(AL,MS)	T
Southern Coal Skink	Eumeces anthracipincus pluvialis	T(MS)	
Alabama Red-bellied Turtle	Pseudemys alabamerisis	T(AL)	
FISH			
Atlantic Sturgeon	Acipenser oryrhynchus	T(AL) E(MS)	

E=Endangered AL = Alabama (list is unofficial)
T=Threatened MS = Mississippi

Source: U.S. Army Corps of Engineers, 1981a; Beccasio et al., 1982; 1983b. Mississippi Department of Wildlife Conservation, Bureau of Marine Resources, 1982.

TABLE 3-25

PLANTS THAT MAY OCCUR IN THE MISSISSIPPI SOUND VICINITY THAT ARE CONSIDERED ENDANGERED, THREATENED OR OF SPECIAL CONCERN IN ALABAMA

Scientific Name	Common Name	Status
Hypericum nitidum	St. Johns wort	T
Hypericum reductum	St. Johns wort	SC
Juncus gymnocarpus		T
Pinguicula planifolia	Butterwort	SC
Pinguicula primulifora	Butterwort	SC
Utricularia floridana	Bladderwort	T
Utricularia inflata	Bladderwort	T
Utricularia purpurea	Bladderwort	T
Lilium iridollae	Lily	E
Pleea tenuifolia	Rush featherline	SC
Lycopodium cernuum	Clubmoss	SC
Ludwigia arcuata		T
Oenothera grandiflora	Evening primrose	E
Botrychium alabamense	Alabama grapefern	SC
Botrychium lunarioides	Winter grapefern	SC
Ophioglossum crotalophoroides	Bulbous adders tongue	SC
Ophioglossum nudicaule	Least adders tongue	SC
Cleistes divaricata	Spreading pogonia	T
Epidendrum conopseum	Green-fly orchid	E
Platanthera integra	Yellow fringeless orchid	SC
Orobanche uniflora		SC
Manisuris tuberculosa	Jointgrass	SC
Panicum nudicaule		T
Potomogeton robbinsii	Pondweed	E
Segeretia minutiflora		T
Sarracenia psittacina	Pitcher-plant	T
Sarracenia rubra	Sweet pitcher plant	T
Agalinis pseudophylla		SC
Penstemon multiflorus		SC
Selaginella ludoviciana	Spikemoss	SC
Gordonia lasianthus	Loblolly bay	T

E - Endangered, T - Threatened, SC - Special concern.

Mississippi has no equivalent plant list.

Alabama list is unofficial.

Source: U.S. Army Corps of Engineers, 1983b.

TABLE 3-25 (Concluded)

PLANTS THAT MAY OCCUR IN THE MISSISSIPPI SOUND VICINITY THAT ARE CONSIDERED ENDANGERED, THREATENED OR OF SPECIAL CONCERN IN ALABAMA

Scientific Name	Common Name	Status
Stewartia malacodendron	Silky camellia	SC
Momisia iguanea		T
Xyris drummondii	Yellow-eyed grass	T
Xyris scabrifolia	Yellow-eyed grass	T
Illex amelanchier		E[a]
Acorus calamus	Sweet flag	T
Peltandra sagittaefolia	Spoon flower	T
Thelypteris dentata	Fern	SC
Thelypteris ovata	Fern	SC
Thelypteris quadrangularis	Fern	SC
Liatris chapmanii	Blazing star	SC
Canna flaccida	Golden canna	T
Cleome tenuifolia	Spider flower	SC
Clethra alnifolia	White alder	SC
Chamaecyparis thyoides	Juniper	SC
Rhynchospora crinipes	Horned rush	E
Kalmia hirsuta		SC
Pieris phillyreifolia		T
Rhododendron austrinum		SC
Eriocaulon lineare	Pipewort	SC
Eriocaulon texenes	Pipewort	SC
Psoralea simplex		E
Quercus minima	Dwarf live oak	SC
Quercus pumila	Running oak	SC
Eustoma exaltatum		SC
Gentiana villosa		E
Sabatia brevifolia		T
Sabatia foliosa		SC

E - Endangered, T - Threatened, SC - Special concern.

Mississippi has no equivalent plant list.

Alabama list is unofficial.

Source: U.S. Army Corps of Engineers, 1983b.

Hydrology

3.208 Water movements are influenced by winds, tides, bottom topography and freshwater inflows from the Mississippi, Mobile, Pascagoula and Pearl Rivers. When the Loop Current from offshore (a clockwise current which may have counter clockwise eddies associated with it) gets close enough to the state waters to influence the nearshore area, it can dominate water movements. Under usual conditions, sustained winds are the primary force controlling water movements in the nearshore Gulf of Mexico (U.S. Army Corps of Engineers, 1978a). Exceptions are primarily due to hurricanes or to nearshore effects of the Loop Current. In general, winds ranging from the northwest to northeast to southeast result in Gulf surface currents moving westerly. Winds from the southeast to southwest to northwest result in easterly water movements. Winds from the northwest or southeast can result in easterly or westerly water movements (U.S. Army Corps of Engineers, 1978a).

3.209 Westerly currents generated nearshore, in areas where water depths are less than 20 feet, have an average velocity of 1.0 to 2.5 knots (1.2 to 2.9 miles per hour) which can increase to as high as 5 knots (6 miles per hour) during flood (incoming) tides. Shoreline sediment movements on the seaward side of the barrier islands show a definite westward trend; the islands are gradually moving westward due to erosion of the eastern ends and accretion along the western ends (U.S. Army Corps of Engineers, 1978a).

3.210 In areas with over 20 feet of water depth, bottom circulation is influenced by a number of forces. Near the passes, tidal forces will often dominate (U.S. Army Corps of Engineers, 1978a).

3.211 Interactions between Mobile Bay, eastern Mississippi Sound and the Gulf of Mexico result in dynamic, constantly changing water movement. Predictions of water movements would vary with wind conditions, and to a lesser extent, with tidal forces and freshwater flows from inland areas.

Water Quality

3.212 The nearshore Gulf of Mexico waters have been classified by the State of Alabama for shellfish harvesting, water contact and fish-wildlife and by the State of Mississippi for water contact and shellfish harvesting. Dissolved oxygen levels in nearshore waters are nearly always at saturation levels; as much oxygen as is able to enter the water remains soluble (U.S. Army Corps of Engineers, 1982a).

3.213 Surface water temperatures in the state jurisdictional waters of the Gulf of Mexico reflect air temperatures. The water column of the nearshore Gulf is said to be marginally stratified during winter and summer months with the following typical water temperatures (U.S. Army Corps of Engineers, 1982b):

Winter season	
surface waters	15 degrees
bottom waters	18 degrees
Summer season	
surface waters	30 degrees
bottom waters	22 degrees

Water temperatures are more uniform with depth during spring and fall seasons.

3.214 Salinity patterns along the continental shelf are primarily affected by mixing of Mississippi River water and other freshwaters with high salinity (34 to 36 parts per thousand) water from offshore. Surface salinities measured during January-February 1976 were ranged from 19 parts per thousand near the eastern end of Dauphin Island to 31 parts per thousand 10 miles offshore. Bottom salinities were less variable, ranging from 30 to 35 parts per thousand. Sudden changes in salinity as a function of location are sometimes evident as well, paarticularly when freshwater flows are significant (U.S. Army Corps of Engineers, 1978a). Seasonal variations in freshwater flows entering Mobile Bay and Mississippi Sound are also an important variable.

Sediments

3.215 Nearshore sediments are predominantly sandy, frequently with some silt and clay content (Figure 3-13). Significant westward transport of sediments occurs at the barrier islands. No information about movement of more offshore sediments or about metal and organic content of any local Gulf sediments has been found in this effort. Vittor is completing a study of benthic communities in Mississippi Sound and the nearshore Gulf which includes analyses (U.S. Army Corps of Engineers, 1982a).

Aquatic ecosystems

3.216 The nearshore aquatic environment inside the 3 mile limit of state waters has not been studied extensively, but some components of the ecosystem have been investigated.

3.217 Benthic Organisms. The beaches and immediately adjacent subtidal area are sandy habitats that may be characterized by species typical of this high energy environment. The clam (*Donax* spp.) mole crab (*Emerita talpoida*), and ghost crab (*Ocypode albicans*) are the larger macroinvertebrates that could occur. A number of mollusc species are found in the subtidal area adjacent to the beach (U.S. Army Corps of Engineers, 1978a).

3.218 Four types of benthic communities have been identified in the nearshore Gulf waters (Barry A. Vittor and Associates, Inc., 1982) (Figure 3-15, end of chapter; Table 3-26). The tidal pass clean sand community has been described in the section on Mississippi Sound. Densities and biomass for most species increased substantially from fall to spring, reflecting the late winter - early spring recruitment period of many of the species.

3.219 Shrimp. Shrimp support an important commercial fishery in the Gulf waters. The nearshore Gulf waters are spawning grounds and the estuaries are the nursery areas. Brown shrimp prefer muddy bottoms and are found in greatest abundance west of Mobile Bay. Peak spawning is during the fall and winter. White shrimp are most abundant east of Mobile Bay. Spawning is mainly in the spring (U.S. Army Corps of Engineers, 1978c).

3.220 Calico Scallops. Calico scallops occur in the waters south of the Fort Morgan Peninsula. The greatest concentrations are in federal waters beyond the 3 mile limit of state waters (U.S. Army Corps of Engineers, 1978c).

3.221 Blue Crabs. The shallow Gulf waters adjacent to the barrier islands are important spawning areas for blue crabs (Mississippi Department of Wildlife Conservation, Bureau of Marine Resources, 1982).

3.222 Finfish. The nearshore Gulf waters support many finfish species both seasonally and permanently. Many of these species are also dependent on adjacent estuarine areas for part of their life cycle. Commercial and sportfishing are carried on in the nearshore environment.

Threatened and Endangered Species

3.223 The U.S. Department of the Interior maintains a list of animal and plant species that are threatened and endangered in the United States. The states of Alabama (Boschung, 1976) and Mississippi have also compiled lists of species that are considered threatened and endangered in those states. The Alabama list is unofficial. Animals from these lists that could occur in the Mississippi and Alabama state waters of the Gulf of Mexico are given in Table 3-27.

TABLE 3-26

NUMERICALLY DOMINANT BENTHIC ANIMALS BY HABITAT TYPE IN THE GULF OF MEXICO OFF ALABAMA AND MISSISSIPPI

Species	Type of Organism	
	OFFSHORE MUD HABITAT	
Magelona cf. *phyllisae*	Polychaete worm	Organism Density
Mediomastus spp.	Polychaete worm	(individ./m^2)
Diopatra cuprea	Polychaete worm	3861
Myriochele oculata	Polychaete worm	
Oxyurostylis smithi	Crustacean	
Paraprionospio pinnata	Polychaete worm	Biomass (g/m^2)
Golfingia tricochephala	Sipunculid worm	5.68
Cerebratulus cf. *lacteus*	Nemertean worm	
	OFFSHORE MUDDY SAND HABITAT	
Mediomastus spp.	Polychaete worm	Organism Density
Magelona cf. *phyllisae*	Polychaete worm	(individ./m^2)
Lumbrineris spp.	Polychaete worm	6150
Aricidea sp.	Polychaete worm	
Paraprionospio pinnata	Polychaete worm	Biomass (g/m^2)
Golfingia trichocephala	Sipunculid worm	6.74
Prionospio cristata	Polychaete worm	
	OFFSHORE CLEAN SAND HABITAT	
Polygordius spp.	Polychaete worm	Organism Density
Lumbrineris spp.	Polychaete worm	(individ./m^2)
Branchiostoma caribaeum	Cephalochordate	2272
Paraprionospio pinnata	Polychaete worm	
Mediomastus spp.	Polychaete worm	Biomass (g/m^2)
Armandia maculata	Polychaete worm	9.06
Spiophanes bombyx	Polychaete worm	

Source: Barry A. Vittor, Inc., 1982.

TABLE 3-27

ENDANGERED AND THREATENED ANIMALS THAT COULD OCCUR IN THE ALABAMA AND MISSISSIPPI STATE WATERS OF THE GULF OF MEXICO

Common Name	Scientific Name	Status State	Status Federal
MAMMALS			
Manatee	Trichechus manatus	E(MS)	E
Humpback Whale	Megatera novaeangliae	E(MS)	E
Blue Whale	Balaenoptera musculus	E(MS)	E
Finback Whale	Balaenoptera physalus	E(MS)	E
Sperm Whale	Physeter catodon	E(MS)	E
Sei Whale	Balaenoptera borealis	E(MS)	E
Right Whale	Eubalaena glacialis		E
BIRDS			
Bald Eagle	Haliaeetus leucocephalus	E(AL,MS)	E
Peregrin Falcon	Falco peregrinus	E(AL,MS)	E
Snowy Plover	Charadrius alexandrinus	E(AL)	E
Brown Pelican	Pelecanus occidentalis	E(AL,MS)	E
Osprey	Pandion haliaetus	E(AL)	
Mottled Duck	Anus fulvigula	T(AL)	
Reddish Egret	Dichromanassa rufescens	T(AL)	
AMPHIBIANS AND REPTILES			
Atlantic Hawksbill Turtle	Eretmochelys imbricata imbricata	E(AL,MS)	E
Atlantic Loggerhead Turtle	Caretta caretta caretta	E(AL,MS)	T
Atlantic Ridley Turtle	Lepidochelys kempi	E(AL,MS)	E
Leatherback Sea Turtle	Dermochelys coreacea	E(AL,MS)	E
Green Sea Turtle	Chelonia mydas	E(AL,MS)	T
FISH			
Atlantic Sturgeon	Acipenser oryrhynchus	T(AL) E(MS)	

E=Endangered AL = Alabama (list is unofficial)
T=Threatened MS = Mississippi

Source: U.S. Army Corps of Engineers, 1981a; Beccasio et al, 1982; 1983b. Mississippi Department of Wildlife Conservation, Bureau of Marine Resources, 1982.

SUBREGIONAL SOCIOECONOMIC CHARACTERISTICS

3.224 The Alabama and Mississippi coastal region contains two principal urban centers: Mobile, Alabama, and Pascagoula to Biloxi-Gulfport in Mississippi. The Gulf Shores-Fort Morgan peninsula in Baldwin County and Dauphin Island in Mobile County, Alabama are also important seasonal beach resorts.

Mobile and Baldwin Counties, Alabama

3.225 Selected aspects of the existing socioeconomic environment of coastal Alabama that could be affected by increased hydrocarbon development are described below. Currently available information is given on population, personal income, labor force, employment, community services, land use, transportation, tourism and outdoor recreation, commercial fisheries and cultural resources.

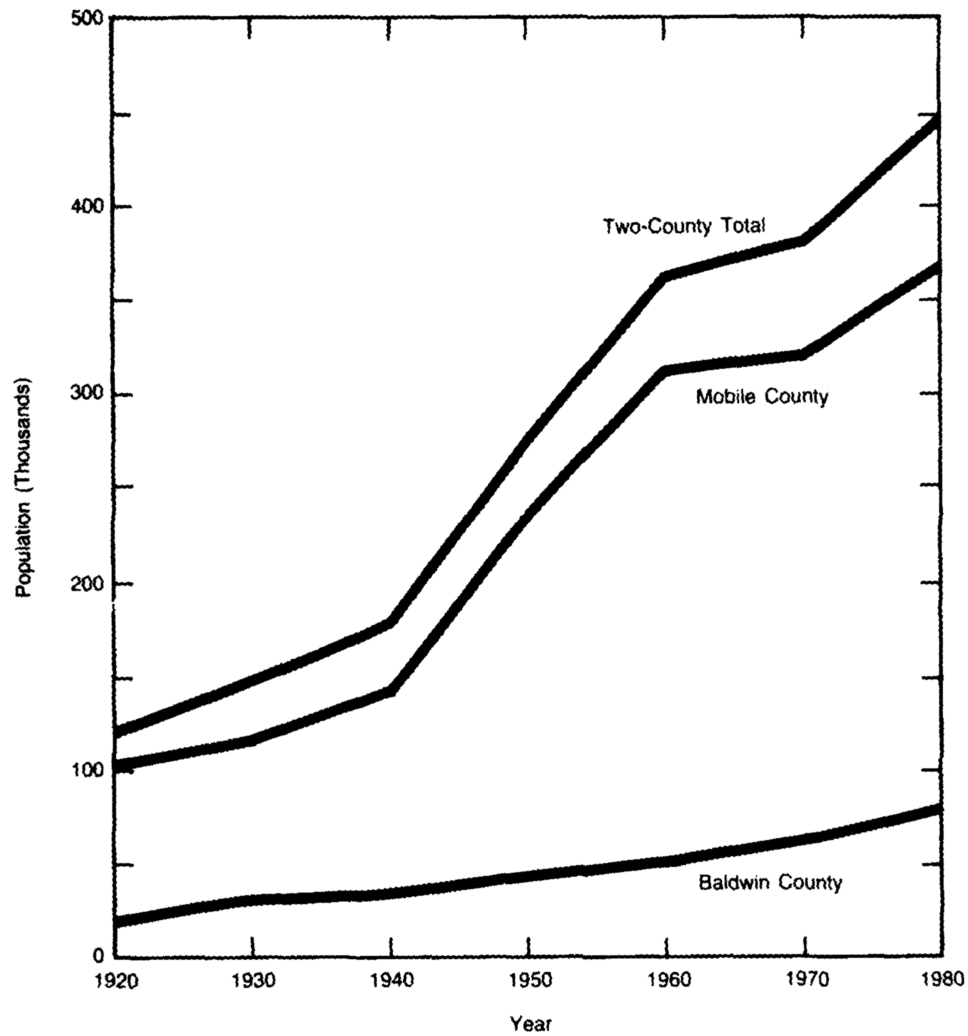
Population

3.226 The 1980 population in Mobile County was about 365,000 and in Baldwin County was almost 79,000 (U.S. Department of Commerce 1982b). Between 1970 and 1980 population gains of 15 and 32 percent respectively were made in Mobile and Baldwin (Figure 3-17). Population projections for the two coastal counties for the years 1990 and 2000 indicate that, on the average the annual growth rate during the 1980's would be just under one percent in Mobile County and 1.4 percent in Baldwin (Alabama Office of State Planning and Federal Programs, 1979). During the 1990's the rate of growth is expected to decrease.

3.227 Mobile County is about 75 percent urban, with 55 percent of the population residing in the City of Mobile which is the second largest city in Alabama (South Alabama Regional Planning Commission, 1982b). Although Baldwin County has grown considerably within the last decade (32 percent) it is more rural in character than Mobile County with about 47 inhabitants per square mile versus 294 in Mobile County (South Alabama Regional Planning Commission, 1981a).

Personal Income

3.228 In 1980 total personal income for the Mobile SMSA was $3.4 billion; by 1981 the total increased to $3.87 billion (U.S. Department of Commerce, 1980b). Over the last decade per capita personal income was higher in Mobile county than in Baldwin (Table 3-28) (Alabama Department of Industrial Relations, 1981a; South Alabama Regional Planning Commission, 1981a). Manufacturing, services, government and trade rank highest as the sources of personal income (Friend et al., 1982). The major difference between



Sources: 1920 - 1970: South Alabama Regional Planning Commission, 1975. 1981a: U.S. Department of Commerce, 1982b.

FIGURE 3-17
POPULATION IN MOBILE AND BALDWIN COUNTIES, ALABAMA FROM 1920 THROUGH 1980

TABLE 3-28

PER CAPITA PERSONAL INCOME FOR MOBILE AND BALDWIN COUNTIES AND THE STATE OF ALABAMA IN 1970, 1975 and 1980

Area	Per Capita Personal Income (dollars) 1970	1975	1980	Percent Change 1970-1980
Baldwin County	2,759	4,611	7,192	160
Mobile County	2,937	4,798	7,751	164
Alabama	2,892	4,634	7,434	157

Source: Alabama Department of Industrial Relations, 1981a.

the two counties is that construction is more important to Mobile County than to Baldwin, where farming is proportionately more important to total county income (South Alabama Regional Planning Commission, 1981a).

Public Revenues from Oil and Gas Development

3.229 The total value of the oil, gas, and condensate produced in the state of Alabama during 1982 has been estimated to be approximately $790 million. State revenue in the form of oil and gas severance taxes has substantially increased along with hydrocarbon production in recent years. In 1970, severance tax revenues for the state was $1.3 million (Bolin and Masingill, 1983). Total severance taxes collected in 1983 on resources produced that year amounted to about $78 million.

3.230 Until 1979 there was a uniform severence tax of 6 percent on all oil and gas produced in the state. In 1980, the tax was raised to 8 percent (Alabama Act No. 80-708). Between February and December 1983 there was a 10 percent tax except for wells producing 10 barrels or less of oil per day, which were taxed at 6 percent (Alabama Act No. 83-889). Presently, the tax is measured at a rate of 10 percent except for wells producing 25 barrels or less of oil per day or 200,000 cubic feet or less of gas per day, which are taxed at 6 percent. For offshore production wells with production depths greater than 18,000 feet below mean sea level the tax is 8 percent (Alabama Act No. 84-328). For offshore resources, the 8 percent tax is composed of a 2 percent production tax and a 6 percent privilege tax. The production tax goes to the state while the 6 percent privilege tax is divided among counties and municipalities in which the production occurs (Burroughs 1983, Personal Communications).

3.231 The discovery of the Lower Mobile Bay Field focused attention on the petroleum potential of Alabama's coastal waters. The interest which was generated from this discovery prompted the State to hold an oil and gas lease sale of selected state owned tracts in Alabama's territorial waters in March 1981. As a result, the state accepted bids on 13 state-owned tracts and received $449 million in bonus monies from leasing rights to explore for hydrocarbons. In September 1982, an additional tract was leased for $3.1 million in bonus money (Bolin and Masingill, 1983). When wells go into production in state waters the state benefits from royalty payments which average about 20 to 25 percent of the current market value of the resource.

3.232 Mobile County currently receives a minimum of 25 percent of the 2 percent privilege tax collected by the State on hydrocarbons sold from onshore production. Mineral rights leasing

on county-owned land and rights-of-way also provide an additional sources of income. In FY 1982 Mobile County received $3.7 million in oil and gas revenues (South Alabama Regional Planning Commission, 1982b).

Labor Force

3.233 Annual average civilian labor force estimates for 1976, 1980, 1981 and 1982 for the two coastal counties are shown by Table 3-29. Between 1976 and 1982 there was about a 13 percent increase in Baldwin county's labor force and a 25 percent increase in Mobile's. The increases are consistent with national trends.

Employment

3.234 Industry has a major role in the economy of coastal Alabama; it accounts for most of the area's personal income and jobs (Table 3-30) (South Alabama Regional Planning Commission, 1981a). As of 1981 manufacturing, service and trade businesses employed the most people in Mobile and Baldwin counties. Within the SMSA, Mobile County accounts for 89 percent of all employment (U.S. Department of the Interior, 1982a).

3.235 The oil and gas extraction sector (Standard Industrial Classification Code (SIC) 13) currently employs just under one percent of Mobile County employees. Contract construction represents about 9 percent of total employment while water transporation, ship building and repair constitute 3 and 4 percent of Mobile's employment respectively. Of these occupations, only contract construction and water transportation are evident in Baldwin. About 8 percent of Baldwin County employment is attributed to construction while 0.6 percent is concerned with water transportation. Planning officials recognize that oil and gas related industries are becoming more important for the two county area. More than 24 percent of oil extracted from Alabama as well as 17 percent of gas and 61 percent of condensate comes from Mobile County. It has been estimated that about 50 facilities which are or could be related to the offshore oil and gas industry exist in the region employing over 8,000 people (Table 3-31) (South Alabama Regional Planning Commission, 1982b). The infrastructure associated with the industry is depicted in Figure 3-18 (end of chapter). Planning projections indicate that the production and refining of oil and gas with its ancillary industries has the largest economic growth potential in the Mobile region.

TABLE 3-29

ANNUAL AVERAGE CIVILIAN LABOR FORCE ESTIMATES FOR 1980, 1981, 1982 IN MOBILE AND BALDWIN COUNTIES ALABAMA

	Civilian Labor Force[a]		Labor Force Participation Rate	
Year	Mobile County	Baldwin County	Mobile County	Baldwin County
1976	141,210	26,810	--	--
1980	154,070	32,830	58.03	56.0
1981	156,260	32,810	--	--
1982	159,880	33,640	--	--

[a]Place of residence basis.

Source: Alabama Department of Industrial Relations 1981a, 1983a.

TABLE 3-30

NUMBER OF EMPLOYEES OF SELECTED INDUSTRY GROUPS FOR THE STATE OF ALABAMA, MOBILE AND BALDWIN COUNTIES IN 1981

Sic[a] Code	Major Industry Group	Number Of Employees[c] Mobile County	Baldwin County	State Of Alabama
-	Agricultural Services, Forestry, Fisheries	1,386	67	5,079
-	Mining	560	18	16,249
13	Oil and Gas Extraction	500-999	b	1,856
131	Crude Petroleum and Natural Gas	20-99	b	250-499
132	Natural Gas Liquids	b	b	20-29
138	Oil and Gas Field Services	438	b	1,443
1381	Drilling Oil and Gas Wells	250-499	b	768
1382	Oil and Gas Exploration Services	b	b	272
1389	Oil and Gas Field Services, nec	100-249	b	358
-	Contract Construction	10,583	1,103	76,729
15	General Contractors and Operative Builders	3,807	518	28,851
16	Heavy Construction Contractors	1,612	162	15,304
17	Special Trade Contractors	5,164	423	32,434
-	Manufacturing	24,846	3,674	354,392
20	Food and Kindred Products	1,602	148	25,718
24	Lumber and Wood Products	1,304	450	25,193
26	Paper and Allied Products	5000-9999	b	18,849
28	Chemical and Allied Products	3,958	131	12,362
29	Petroleum and Coal Products	655	b	1000-2499
3731	Ship Building and Repairing	4,393	b	b
-	Transportation and Other Public Utilities	8,967	733	67,715
44	Water Transportation	3,503	90	4,192
49	Electric Gas and Sanitary Services	500-999	b	16,115
492	Gas Production and Distribution	250-499	b	2,353
-	Wholesale Trade	9,390	797	70,795
51	Wholesale Trade-Nondurable Goods	3,036	507	25,647
517	Petroleum and Petrol. Products	505	b	4,014
-	Retail Trade	23,683	3,904	196,394
-	Finance, Insurance, Real Estate	6,454	923	59,717
-	Services	25,250	2,650	194,948
79	Amusement and Recreational Serv.	1,147	162	

[a]SIC=Standard Industrial Classification.
[b]Group is not listed.
[c]Actual data are withheld in some cases to avoid disclosing figures for individual companies; employment ranges are given instead.
Source: U.S. Department of Commerce, 1983a.

TABLE 3-31

EXISTING FACILITIES THAT ARE OR COULD BE INVOLVED IN OFFSHORE OIL AND GAS EXPLORATION AND DEVELOPMENT WITH ESTIMATED EMPLOYMENT IN COASTAL ALABAMA FOR 1980

Activity	Number of Facilities	Total Employment
Outer Continental Shelf exploration and development	7[b]	2,009[c]
Alabama offshore exploration and development[a]	13[b]	660[c]
Outer Continental Shelf onshore support facilities	30	5,550
TOTAL	50	8,219

[a] Offshore drilling activity on state submerged lands.
[b] Lease sales.
[c] Includes constructing and operating employment.

Source: South Alabama Regional Planning Commission, 1981d.

Unemployment

3.236 Unemployment rates have been lower along Alabama's coast than in the state as a whole (Table 3-32) (Alabama Department of Industrial Relations, 1984). In 1983, unemployment in the state of Alabama was 13.7 percent. The same year the rate in Mobile County was 15.9 percent and the rate in Baldwin was the lowest at 12.3 percent (Alabama Department of Industrial Relations, 1984).

Solid and Hazardous Waste

3.237 Existing federal and state regulations pertaining to the disposal of solid and hazardous waste associated with offshore oil and gas development in Alabama are described in the following section. The description is followed by a summary of waste handling practices and disposal sites currently used in Mobile and Baldwin counties. The latter section includes an inventory of organizations in the area which are currently involved or could potentially become involved with related solid waste (i.e., drilling mud) treatment and/or disposal.

3.238 Regulatory Framework. The Resource Conservation and Recovery Act (RCRA) specifically excludes from regulation as a hazardous waste drilling fluids and wastes produced from hydrocarbon exploration, development and production. In addition, the U.S. Environmental Protection Agency (the federal level governing body), has acknowledged that the disposal of nonhazardous solid wastes is a state and local problem. The EPA has, however, a proposed set of criteria to assist localities in designing solid waste disposal regulations. The U.S. EPA Region IV administers the Alabama solid waste disposal program. Once federal criteria are met states can independently administer their own programs.

3.239 Under the federal Coastal Zone Management Act, state governments have been encouraged to develop and administer their own coastal zone management programs. The original intent of the act is to ensure that all federal actions affecting a state's coastal zone would be consistent with federally approved state plans. Specific to the wastes generated by hydrocarbon development, requirements have been set which prohibit or place restrictions on the siting of solid waste disposal facilities along the Alabama coastal zone.

3.240 State authority to regulate waste from offshore hydrocarbon development in Alabama is vested in the Alabama Department of Environmental Management (ADEM), Division of Solid and Hazardous Waste. The Office of State Planning and Federal Programs is responsible for administering pertinent procedures under the federally approved Coastal Zone Management program. The Industrial Waste Water Division of ADEM and the Oil and Gas Board preside over

TABLE 3-32

UNEMPLOYMENT IN MOBILE AND BALDWIN COUNTIES, AND
THE STATE OF ALABAMA FOR 1980, 1981, 1982 AND 1983

	Unemployment Rate (Percent)		
Year	Alabama	Mobile County	Baldwin County
1980	8.8	7.6	6.9
1981	10.7	9.6	7.7
1982	14.4	14.0	12.1
1983	13.7	15.9	12.3

Source: Alabama Department of Industrial Relations, 1984.

liquid wastes disposed of by underground injection wells (an overview on liquid waste injection is contained in the groundwater section). Under Rule 400-3-X-03 of the State Oil and Gas Board Administrative Code, there are provisions preventing the disposal of oil and related wastes into state waters. All muds and other solid wastes must be incinerated or transported to shore for disposal. As in federal RCRA legislation, drilling fluids and waste produced by hydrocarbon activity are excluded from hazardous waste regulation in the State of Alabama. There are no specific disposal requirements under the Alabama Solid Waste Disposal Act for treated drill cuttings or muds. Once treated, hydrocarbon wastes are handled as any other solid waste. Disposal facilities, however, must be permitted under the act's general requirements.

3.241 Waste Handling Practices and Disposal Facilities in Coastal Alabama. Prior to disposal at a certified site, drilling muds and cuttings must be treated and solidified to assure the material is non-hazardous and in a form appropriate for solid waste disposal. To regulate this, ADEM requests disposers to provide EP toxicity tests are conducted each time there is a change in the source of the waste or a change in the physical and chemical composition of the material. Secondly, the wastes can only be disposed of in solid form to accommodate normal heavy equipment at a certified landfill. Once separated the liquids are generally treated and then discharged. Several companies in southern Alabama have been involved in or are currently active in treating locally generated drilling wastes. These firms are listed in Table 3-33.

3.242 Area businesses treating drilling wastes dispose of them differently. Petro-Chem Disposal Services, Inc. in Mobile County barges their processed wastes to one of two Louisiana firms: T and T Disposal Company or Intercoastal Oil Field Fluids. Petro-Chem is permitted by Louisiana and Alabama agencies and they possess an NPDES permit for their discharge. Resource Consultants, Inc., also in Mobile, transports their treated wastes to a Browning-Ferris Industries site in Jackson County, Mississippi. Caren Inc., however, disposes of the solidified waste locally.

3.243 The Alabama Department of Environmental Management, Division of Solid and Hazardous Waste records indicate that 17 landfill and sanitary landfill sites are permitted in Baldwin and Mobile Counties. Of these sites, nine are privately owned and operated. Four of these serve only the specific disposal needs of one or several adjacent industrial users. None of the disposal sites are permitted for hazardous wastes and only two are currently permitted for the disposal of industrial non-hazardous material which includes treated drilling waste; these are the Chunchula Sanitary Landfill in Mobile County and the Magnolia Landfill in

TABLE 3-33

EXISTING DRILLING MUD AND CUTTING TREATMENT COMPANIES IN MOBILE AND BALDWIN COUNTIES, ALABAMA

Company	Treatment Process
Petro-Chem Disposal Services, Inc. Mobile, AL	Flocculation/ sedimentation and disposal of solids
Caren, Inc. Daphne, AL	Chemical fixation
Environmental Disposal Systems, Inc. Mobile, AL	Filter and reinjection of fluids
Alabama Pumping Services Houma, LA	Dewater/solidify and disposal of solids
Resource Consultants, Inc. Mobile, AL	Dewater/solidify and disposal of solids

Baldwin County. The Chunchula Sanitary Landfill site, located in northern Mobile County, was approved during 1982 for the disposal of non-hazardous industrial wastes in addition to household garbage and commercial solid wastes. In 1983 the facility was certified by ADEM to accept pretreated drilling muds. Due to adjacent land available for expansion, the site has an indefinite remaining life. The Magnolia Sanitary Landfill, located on a 230+ acre site leased from the federal government, is permitted to accept household garbage, commercial solid waste, septic tank pumping, and industrial non-hazardous waste. The industrial non-hazardous waste category includes pretreated drilling wastes, five bargefuls of which were disposed of in Magnolia on an experimental test basis.

3.244 A special study was conducted for the Baldwin County Commissioners by McCrory and Williams (1982) to address the feasibility of disposing of drilling wastes at the Magnolia site. The EPA however, has not yet completed a thorough review of the study, so the conclusions that drilling wastes could be disposed of on-site after dewatering without significant impacts should be viewed cautiously. Stringent safeguards were imposed in terms of testing the material at the drill site, testing the material at the receiving point, and monitoring groundwater wells to assure that no hazardous or toxic materials would be disposed of on-site. The initial test disposal of drilling wastes was designed to assess these safeguards, as well as procedures to determine the physical composition of the material.

3.245 Although there is no formal difference between landfills that accommodate commercial non-hazardous solid wastes and industrial non-hazardous waste, any facility requesting permission from the state to dispose of solidified drilling materials must have acceptable soil types, heavy equipment and fulfill other requirements to be approved. Depending on conditions such as these, it is possible that any of 17 landfills in the two coastal counties could at some point in the future be approved to accept treated drilling wastes.

Transportation

3.246 The regional transportation system, including roads and highways, railroads, airports, waterways and port facilities is shown by Figure 3-19 (end of chapter). The Alabama coastal area has a well developed roadway system consisting of six U.S. highways, two interstates (I-10 and I-65) and a secondary system of state and county roads serving the urban and rural areas (South Alabama Regional Planning Commission, 1981a). Four rail systems provide service throughout the region. In Mobile County, the railroad lines radiate from the port and major industrial centers. The Alabama State Docks Terminal Railway connects the railroads to portside tracks and other marine terminal facilities.

3.247 Utilities. Electricity is provided to south Alabama by the Alabama Power Company. Two coal-fired steam generating plants are located in the area (U.S. Army Corps of Engineers, 1979a). The United Gas Pipeline Company furnishes natural gas to the region. Other suppliers in Mobile County are the cities of Bayou La Batre, Citronelle and the Clark-Mobile County Gas District. In the past several decades, some of the most significant gas discoveries in the Gulf Coast region have occurred in Mobile, Baldwin and Escambia counties. The region is thus in an extremely competitive position to supply gas to new and expanding customers and no shortages are anticipated in the foreseeable future (South Alabama Regional Planning Commission, 1981a). Major gas lines through the region are shown in Figure 3-20 (end of chapter).

3.248 Port Facilities and Waterways. Water transportation plays an important role in the economy of the area. There are several ports or harbors in the vicinity, including the ports of Mobile, Chickasaw, the Theodore industrial complex, Bayou la Batre, Bayou Coden and Bon Secour River, while the Gulf Intracoastal Waterway traverses the lower Mobile Bay. In recognition of potential shorefront use conflicts, at present and in the future, Special Management Areas (SMA's) have been designated in certain states with approved Coastal Zone Managment Plans. The SMA's are designated because their economic or recreational opportunities can be effectively realized only through site specific planning and management. The designations do not impose new regulatory authority. Rather, they serve to highlight the need to resolve conflicts of the many and varied uses of the coastal zone. Industrial and port areas, shorefront access and urban waterfronts can all be designated as SMA's. Along the Alabama coast, there is a high degree of urban concentration, and shoreline use is highly competitive, at and around the Port of Mobile. The port, designated as an SMA, includes the urban waterfront of the Theodore industrial complex, from Brookley industrial area to the confluence of the Mobile river and Three-Mile Creek including Pinto Island, McDuffie Island and Blakely Island. The port is important to the economic stability of the coast. Since a significant increase in port activity is expected from both industrial and energy development, long range planning to balance competing uses from activities such as hydrocarbon resource development, shipbuilding and fishing is needed. The designation as an SMA highlights the need for balanced uses by all competing interests.

3.249 Other non-designated waterfront areas in the region could experience an increase in hydrocarbon development activity, and possible competition with other existing uses and future plans. Although not designated as SMA's the following shorefront areas would be likely locations for future hydrocarbon support facilities:

- Bayou la Batre
- Bayou Coden
- East Fowl River, and
- Dauphin Island (used as staging area for personnel transfers for Mobil Oil).

The following paragraphs provide descriptions of the major port facilities and waterways. Total tons, ton-miles and number of vessel trips within the major waterways along the Alabama gulf coast in 1981 are exhibited by Table 3-34 (U.S. Army Corps of Engineers, 1983a).

3.250 The Port of Mobile, run by the Alabama State Docks, is the third largest and best-equipped Gulf port located close to deep water (Alabama State Docks, 1977; U.S. Department of Interior, 1981b; Alabama Coastal Area Board, 1980). It is served by an excellent network of surface transportation. Surface water access to the Port of Mobile is available by a 40-foot deep navigation channel (South Alabama Regional Planning Commission, 1981a). The State Docks currently own about 2,580 acres of land at the Port (Alabama State Docks, 1977). During 1981 $100 million in bonds were sold to finance expansion projects at the facility; 100 acres of waterfront property were also acquired (Alabama State Docks, 1981).

3.251 North of the Alabama State Docks, within Mobile's corporate limits, is the Port of Chickasaw. It has surface water access to the Mobile River via a 25 foot federally authorized channel traversing Chickasaw Creek (U.S. Army Corps of Engineers, 1982c).

3.252 The Theodore Industrial Park located on the west side of the Bay (Mobile County), has a 40-foot ship channel and a large turning basin. It is also owned by the State Docks and makes deepwater available at prime industrial sites. About $750 million in capital expenditures have been invested in the establishment largely because the waterway and channel are expected to attract other major industries to the area (Alabama State Docks, 1981). The State Docks own considerable land in the park (U.S. Department of Interior, 1981b).

TABLE 3-34

WATERBORNE TRAFFIC IN COASTAL ALABAMA FOR 1981

Harbor or Waterway	Total Commodities, Domestic (Short Tons In Millions)	Total Ton Miles (Millions)	Average Haul Per Ton (Miles)	Number of Self-Propelled Vessel Trips, 1981			
				Direction	Trips Per Direction	Direction	Trips Per Direction
Gulf Intracoastal Waterway Pensacola, FL to Mobile Bay, AL	8.25	381	46.2	EASTBOUND	2,181	WESTBOUND	8,077
Mobile Bay, AL to New Orleans, LA	1.7	1,740	100.3	EASTBOUND	3,826	WESTBOUND	3,945
Mobile Harbor, AL[a]	37.6	1,100	29	INBOUND	4,714	OUTBOUND	4,774
Black Warrior and Tombigbee Rivers, AL[b]	15.9	4,900	312	UPBOUND	3,468	DOWNBOUND	3,404

[a]Section Included: Entrance, Bay and River Channels, and channels into Chickasaw and Three Mile Creeks.

[b]Section Included: Mouth of Chickasaw Creek to mile 427 on Mulberry Fork, mile 427.6 on Sipsey Fork and mile 407 on Locust Fork of Black Warrior River.

Source: U.S. Army Corps of Engineers, 1983a.

3.253 Bayou La Batre is a center of the seafood industry in Mobile County, ' at building also occurs there. The port is smaller than those previously described and has a 12 foot deep channel. It has been used as a staging ground for servicing offshore hydrocarbon rigs in the region and has been considered a possible future staging location by several oil companies (U.S. Army Corps of Engineers, 1982b). Bayou Coden and Bon Secour River, like Bayou la Batre, are used for commercial fishing landings.

3.254 An extensive system of inland waterways is tributary to the Port of Mobile. Barge navigation is accommodated as far north as Birmingham. The Tennessee-Tombigbee Waterway Project will connect the Port of Mobile to the Tennessee River, Ohio River and then to the Mississippi and its tributaries (South Alabama Regional Planning Commission, 1981a). The Tenn-Tom project is expected to attract water-oriented industry to these areas and necessitate an expansion of port facilities (Friend et al., 1982).

3.255 The Gulf Intracoastal Waterway extends 1,100 miles along the Gulf coast crossing the lower end of Mobile Bay. It is 12 feet deep and a minimum and 125 feet wide (South Alabama Regional Planning Commission, 1981a). Over time a heavily used shipping pattern has developed in both the offshore and coastalwaters. Ships using open Gulf waters use a system of established safety fairways, linking the major Gulf ports.

Land Use

3.256 A 1975 land use inventory for Mobile and Baldwin Counties is summarized in Table 3-35, while pertinent extracts are presented below. The following account is broken into two parts; the county's existing land-use in general and use of the coastal lands specifically.

3.257 Land Use in Mobile and Baldwin Counties. By far the largest segment of land use in both Alabama coastal counties is devoted to forests (including planted pine) and forest related uses (South Alabama Regional Planning Commission, 1981a); roughly 49 percent and 47 percent of Mobile and Baldwin respectively. Agriculture land use ranks second in both counties (Table 3-35). Cropland is the dominant agricultural use, with soybeans, nursery crops, and vegetables ranking highest. The acreage for developed land uses reflects Mobile's greater commercial, industrial, transportive and residential development over Baldwin's. Most of the developed land in the region is concentrated on either side of the upper Bay. At the southern end, the only areas of urban significance are Dauphin Island and Gulf Shores.

TABLE 3-35

LAND USE IN MOBILE AND BALDWIN COUNTIES FOR 1975 AND PROJECTED TO 2000

Land Use	1975 (Acres) Mobile County	1975 (Acres) Baldwin County	1975 (Acres) Total	2000 (Acres) Mobile County	2000 (Acres) Baldwin County	2000 (Acres) Total	Percent change 1975-2000 (Acres) Mobile County	Percent change 1975-2000 (Acres) Baldwin County	Percent change 1975-2000 (Acres) Total
Developed									
Residential	35,151	9,651	44,802	52,434	14,667	67,101	+49.2	+52.0	+49.8
Commercial	4,002	1,159	5,161	6,253	3,398	9,651	+56.2	+193.2	+87.0
Industrial	4,808	568	5,376	8,350	1,133	9,483	+73.7	+99.5	+76.4
Roads	30,891	16,786	47,677	47,199	26,140	73,339	+52.8	+55.7	+53.8
Other TCU[a]	7,680	3,141	10,821	8,905	3,793	12,698	+16.0	+10.8	+17.3
Government, education miscellaneous	8,968	3,192	12,160	10,640	3,700	14,340	+18.6	+15.9	+17.9
Cultural, recreational, entertainment	4,336	4,388	8,724	5,286	4,756	10,042	+24.2	+8.4	+15.1
Resource production/ extraction[b]	530,336	722,079	1,252,415	526,563	721,053	1,247,616	-0.7	-0.1	0.4
Subtotal	626,172	760,964	1,387,136	665,630	778,640	1,444,270	+6.3	-2.3	+4.1
Undeveloped									
Vacant	66,887	74,874	141,761	27,429	57,198	84,627	-59.0	-23.6	-40.3
Water	22,343	46,462	68,805	22,343	46,462	68,805	--	--	--
Wetlands	78,198	174,082	252,280	78,198	174,082	252,280	--	--	--
Subtotal	167,428	295,418	462,846	127,970	277,742	405,712	-23.6	-6.0	-12.3
Total	793,600	1,056,382	1,849,982	793,600	1,056,382	1,849,982	--	--	--

[a]Transportation, communication, utilities.

[b]Agriculture, forest, mining.

Source: South Alabama Regional Planning Commission, 1977.

3.258 Coastal Land Use in Alabama. The Alabama coast varies from sandy beaches to tidal marshes in the two counties. It is dominated by Mobile Bay which is mostly enclosed by barrier islands. The Gulf shoreline of the islands is all beach about 46 miles long; behind the islands is a mixed marsh and beach shoreline. The total Alabama shoreline is 352 miles long, 71 percent of which is beach (U.S. Department of the Interior, 1981c, 1982a).

3.259 South Baldwin County's gulf shoreline has been developed extensively from Gulf Shores to Perdido Bay. Most of the structures are single family residences or seasonal accommodations including condominiums. The western shore of Mobile Bay (Mobile County) has been developed similarly. Between Alabama Port and the Theodore channel most development consists of weekend homes and some permanent residences. North of the Theodore channel to Battleship Parkway, however, industrial activity increases becoming intense at the Port of Mobile. Above the City of Mobile, along the Mobile River, there are widely scattered industries interspersed with open areas, fish camps and a few permanent homes (Alabama Coastal Area Board, 1980). The development in South Mobile Countyalong the Gulf consists of fishing camps and the towns of Coden and Bayou La Batre. The remaining coastline is marsh area (Alabama Coastal Area Board, 1980).

3.260 Dauphin Island has wide sandy beaches on both the Gulf and Bay shores, with marsh dominant on the side facing Mississippi Sound. About half the Island is developed as residential with a few tourist accommodations (Alabama Coastal Area Board, 1980). Most of Alabama's shoreline is privately owned.

Tourism and Outdoor Recreation

3.261 Coastal Alabama offers a wide variety of recreational opportunities to residents and visitors. Dauphin Island (off the coast of Mobile County) and Pleasure Island (the gulf peninsula in Baldwin) are two major recreation spots. Popular outdoor activities include fishing, boating, swimming, hiking, hunting and camping. Gulf State Park at Gulf Shores in Baldwin County serves as a center for these activities. In 1982 about 1.5 million people visited the park while 114,000 went to Fort Morgan (South Baldwin Chamber of Commerce, 1983). Several examples of major local attractions and annual events are given below:

- Bellingrath Gardens and Home with an annual visitation of about 100,000 people who spend about $4.1 million.

- The Annual Fleet Blessing at Bayou La Batre attended by about 14,000 individuals who spend about $0.2 million (U.S. Army Corps of Engineers, 1982b).

- The Alabama Deep Sea Fishing Rodeo on Dauphin Island with about 2,500 participants (pre-Hurricane Frederick) and 50,000 to 100,000 spectators spending $50,000 to $65,000.

- The Senior Bowl Football Game

- Sailing Regattas

- Mardis Gras

- Seafood Festivals

- The Greater Gulf State Fair

- America's Junior Miss Pageant

- Bon Secour National Wildlife Refuge

- Battleship USS Alabama, and

- Mobile-Tensaw River Bottomlands - a national natural landmark

These annual events, and ongoing recreational attractions are part of a major income producing industry in the area. In 1981, the state of Alabama received about $2.5 billion dollars from the travel industry (up 7 percent over 1980) a fourth of which is thought to originate from the Mobile-Gulf coast area (Adams, 1981).

3.262 Spring and summer are the primary tourist seasons along the coast. There is 32 percent visitorship between April and June and 30 percent between July and September (Friend et al., 1982). The number of tourists visiting major attractions in the coastal region for several years is shown by Table 3-36. The location of major attractions is exhibited Figure 3-21 (end of chapter).

3.263 Water Based Recreation. Boating is a popular activity along coastal Alabama. The Mobile River Delta, Bay, Little Lagoon, Mississippi Sound and Perdido Bay estuary have more than 400,000 surface acres of water used for boating, fishing and hunting. In 1980 there were over 222,700 motor boat registrations in the state of Alabama (U.S. Department of the Interior, 1982a). The number of

TABLE 3-36

NUMBER OF VISITORS AT MAJOR TOURIST ATTRACTIONS IN THE ALABAMA COASTAL REGION FOR SELECTED YEARS FROM 1960 to 1982

Tourist attraction	Number of Visitors							
	1960	1970	1977	1978	1979	1980	1981	1982
Gulf State Park[a]	NA	1,598,228[e]	NA	2,807,000[g]	1,200,000[g]	745,100[e]	1,200,000[g]	1,500,000[g]
Battleship USS Alabama[e]	b	255,991	360,295	330,578	245,526	246,021	--	--
Bellingrath Gardens[a,e]	105,091	111,833	211,124	217,037	--[c]	85,716[c]	--	--
Fort Conde[e]	b	b	61,623	48,357	NA	NA	--	--
Fort Morgan[e]	NA	NA	165,988	147,624	131,252	84,342	120,000	114,221[f]
Fort Gaines[e]	NA	NA	29,150	25,872	24,350	125[d]	--	--

[a]For fiscal years ending September 31 for: FY78-79, 79-80, 81-82, 82-83.

[b]Not in operation.

[c]Closed September 12, 1979, to March 1, 1980, due to hurricane damage.

[d]Fort Gaines pier, which accounted for the majority of the facility's visitors, was destroyed by Hurricane Frederic in 1979.

[e]Source: Friend et al., 1982.

[f]Source: South Baldwin Chamber of Commerce, 1982 and 1983.

[g]Source: Gulf State Park, 1983, Personal Communications.

boat owners who use their crafts in the Gulf is not known, however, some studies indicate that 5-10 percent of the state registered motor boats venture into the Gulf (U.S. Department of the Interior, 1981c).

3.264 The number of boat licenses issued in the Alabama coastal region in 1979-1980 exceeded 25,000 (Table 3-37). In 1975 1,098 berths were available at 16 Mobile County marinas , while 1,137 berths were available at 34 marinas in Baldwin. Also that year 16 boat ramps were located in Mobile while Baldwin had 48 public and private launching facilities (Alabama Coastal Area Board 1980). About 40 charter boats in the area operate mostly out of Dauphin Island and Orange Beach. There are as many as 20 artificial fishing reefs offshore of Alabama. They attract snapper, grouper, and triggerfish among other species and are a focus for recreational fishermen who congregate at the sites for charter and private fishing excursions (Friend et al., 1982; Alabama Department of Conservation and Natural Resources, undated)

3.265 Recreational Fishing. Results from the 1979 Marine Recreational Fishery Survey (U.S. Department of Commerce, 1980a)indicate that about 204,000 people participated in coastal fishing between January and December 1979 in Alabama; 70 percent of these people originated from the coastal area. In all 958,000 fishing trips were made offshore; most catches, though, were beyond the three mile limit. One recreational fishing study (1975) found that fishermen spent about $5 million to catch 8 million pounds of fish along the Alabama Coastal Zone (Alabama Coastal Area Board, 1980).

3.266 The major sport fish in Alabama's estuarine waters are: spotted sea trout, southern kingfish, sheepshead, red drum, flounder, croaker and mullet along with shrimp, crabs and oysters. In low salinity and fresh water the large mouth bass is most popular followed by sunfish and catfish. The primary offshore Gulf species are king and spanish mackerel, cobra, red snapper, and grouper (Alabama Coastal Area Board, 1980).

3.267 Sport fishing is also popular in the Mobile Delta. Fishermen spent an estimated $4.9 million between December 1980 and November 1981 to harvest over 370 tons of Delta fish (Table 3-38). Active gear sport fishing accounted for 97 percent of all fisherman trips, 89 percent of the total harvest, and almost 97 percent of total fisherman expenditures (Table 3-38) (Malvestuto et al., 1983).

3.268 Water Fowl Hunting. Many migratory waterfowl use the estuaries along coastal Alabama as a stopover area. The Mobile Delta is one of the two most concentrated areas of waterfowl

TABLE 3-37

NUMBER OF BOAT LICENSES SOLD BY BOAT CLASSES[a], MOBILE AND BALDWIN COUNTIES, ALABAMA, FOR SELECTED YEARS THROUGH 1980

County, license type	1959-60	1964-65	1969-70	1974-75	1979-80
Mobile County					
Class I	7,703	8,534	10,557	11,962	11,886
Class II	1,869	2,457	3,607	4,632	5,775
Class III	362	393	NA	361	429
Class IV	29	19	NA	23	34
Subtotal	9,963	11,403	NA	16,978	18,124
Baldwin County					
Class I	2,774	2,199	2,704	4,701	4,686
Class II	425	377	686	1,757	2,036
Class III	125	53	NA	170	175
Class IV	11	5	NA	14	18
Subtotal	3,335	2,634	NA	6,642	6,915
Coastal Region					
Class I	10,477	10,733	13,261	16,663	16,572
Class II	2,294	2,834	4,293	6,389	7,811
Class III	487	446	NA	531	604
Class IV	40	24	NA	37	52
Total	13,298	14,037	NA	23,620	25,039

[a]Class I - boats less than 16 ft. in length; Class II - boats at least 16 ft. but less than 26 ft; Class III - boats at least 26 ft. long but less than 40 ft.; Class IV - boats 40 ft. or more in length.

NA - Not available.

Source: Friend et al., 1982 from Alabama Department of Conservation and Natural Resources, Division of Marine Police.

TABLE 3-38

PASSIVE AND ACTIVE GEAR SPORT FISHING IN THE MOBILE DELTA BETWEEN DECEMBER 1980 AND NOVEMBER 1981

Fisherman Trips	Harvest (lbs.)	Harvest Per Acre	Fisherman Expenditures ($)	Consumers Surplus[a] ($)
Active Gear Sport Fishery				
385,000	667,000	22.2	4.8 million[a]	5 million[b]
Passive Gear Sport Fishery				
11,000	82,000	2.6 lbs.	128,000[a]	

[a]Fixed and Variable Costs.

[b]Indirect Estimate.

Source: Malvestuto et al., 1983.

congregations in the State (Alabama Travel Department, undated). The most numerous species of duck are gadwall, canvasback, green-winged teal and baldpate. Coot are abundant but geese often fly over without stopping. Private hunting and fishing camps can be observed along the water throughout the Delta area. Each year a count of waterfowl hunters is made in the Mobile Delta during the first three days of the season (Table 3-39). It has been estimated that the count represents about a third of the participants, and that most of the hunters are local people. Fewer than 5 percent are believed to come from outside the immediate area (Davis, 1983; Personal Communication).

3.269 Public Access. A total of 10,963 acres of publicly owned or maintained shorefront recreation areas provide access to coastal waters in the two counties. Several public and private facilities provide access to the Mobile-Tensaw and Delta areas as well. Principal recreation and access areas, and marinas in the region are shown in Figure 3-22 (end of chapter).

Commercial Fisheries

3.270 With landing valued at over $40 million at dockside in 1981, the commercial marine fisheries industry is a major componentin Alabama's coastal economy. Of the 30 species of fish and shellfish landed, shrimp alone account for over $38 million or nearly 90 percent of the dollar volume of the 1981 landings (Southeast Fisheries Center, 1982e). The major fish and shellfish species (Table 3-40) accounted for over $43.5 million or better than 99 percent of the 1981 landings. The relatively poor contribution of oysters to the 1980 landings reflects the destructive effects of Hurricane Frederick in the fall of 1979 when the oyster reefs were covered with mud and sand. In order to aid recovery, the Alabama Department of Conservation and Natural Resources planted 791 acres of clam shell in lower Mobile Bay and eastern Mississippi Sound (O'Neil and Mettee, 1982).

3.271 The landings include species taken in Mobile Bay, Mississippi Sound, and the open waters of the Gulf of Mexico. While oysters and shrimp are taken from the bay and the sound, red snapper are taken on banks near the edge of the continental shelf in the open Gulf. However, even those species taken in the open Gulf are generally dependent on the shallower estuarine areas at some stage of their life history.

3.272 Oysters occur in many areas of Mobile Bay but the greatest concentration for commercial harvest is the Cedar Point reef complex between Dauphin Island and the mainland. Throughout the bay area there are approximately 3100 acres of reefs.

TABLE 3-39

WATERFOWL HUNTING IN THE MOBILE DELTA
THE FIRST THREE DAYS OF THE SEASON
FOR 1979 THROUGH 1982

Item Counted	Number Of Counted Items During The First Three Days Of The Season 1979/1980	1980/1981	1981/1982
Hunters	297	288	210
Ducks	387	468	--
Coots	517	345	--

Source: Davis, 1983, Personal Communication.

TABLE 3-40

COMMERCIAL MARINE FISHERIES LANDINGS IN ALABAMA

Species	1981 Landings (dollars)	1980 Landings (dollars)
SHELLFISH		
Shrimp	38,096,113	30,658,698
Oysters	2,002,392	72,265[a]
Blue Crab	849,922	464,583
Subtotal	40,948,427	31,195,546
FISH		
Croaker	1,480,022	937,062
Red Snapper	653,209	423,100
Flounder	304,313	225,802
Black Mullet	187,468	127,042
White Sea Trout	140,402	153,204
Other[b]	272,156	164,013
Subtotal	3,037,570	2,030,223
GRAND TOTAL	43,985,997	33,225,769

[a]The low dollar volume in 1980 reflects the effects of Hurricane Frederic in the fall of 1979.

[b]Other includes: bluefish, bonito, butterfhish, cobia, crevalle, black drum, red drum, groupers, jewfish, king whiting, paddlefish, pompano, sea bass, sea catfish, spotted sea trout, shark, sheepshead, spanish mackerel, spot, squid, swordfish, tuna, and wahoo.

Source: Southeast Fisheries Center, 1982a.

3.273 Although nowhere near as extensive as the marine fisheries, the Mobile Delta does support some level of commercial fishing. There are about 240 commercial fishermen active in the Delta but only about 25 percent of them fish full time for a living (Malvestuto et al., 1983). During 1981, about 320 tons of fish were harvested with an approximate market value of $450,000. Although early 20 species are harvested, the primary catches are smallmouth buffalo, catfish and paddlefish and these species comprise nearly 90 percent of the catch. Table 3-41 presents the major species harvested in the Delta.

Cultural Resources

3.274 The coastal area of Alabama has a rich cultural heritage, ranging from prehistoric Indian sites to locations associated with more recent peoples and events. The following paragraphs present a summary discussion of the archaeological and historical resources of the area.

3.275 Archaeological Resources. The rich natural resources that attracted the early European explorers and settlers to the area were also the focus for the many prehistoric inhabitants. The shores of Mobile Bay, Mississippi Sound and the offshore islands are rich in shell middens (mounds of shucked bivalve shells) while the Mobile Delta has a variety of sites, including the largest temple mound complex in south Alabama (U.S. Army Corps of Engineers, 1980 and 1981a; Alabama Historical Commission, 1978, O'Neill and Mattee, 1982). Friend et al. (1982) reports that there are about 2,000 sites in coastal Alabama, dated at least to 4,000 years before the present and probably to 10,500 years before the present. Because of the potential looting of sites that can occur with the publication of specific site data, the exact locations and individual descriptions of known archaeological sites have been omitted from this report.

3.276 Historical Resources. The historical associations of the area range from the earliest explorers of this continent through to more recent events. Table 3-42 presents a brief chronology of early events in Alabama. Historical resources in the area include sites of French forts, early homes and commercial buildings, lighthouses, and existing forts such as Fort Gaines (1818) on Dauphin Island and Fort Morgan (1833) at Mobile Point (Alabama Historical Commission, 1978). The Union ironclad, U.S.S. Tecumseh, is under 30 feet of water in Mobile Bay, north of Fort Morgan. The historical richness of the area is seen by the number of listings in historical site registers: over 50 listings in the National Park Service's National Register of Historic Places and nearly 20 listings in the Alabama Historical Commission's Alabama Register of

TABLE 3-41

COMMERCIAL FISHERIES LANDINGS IN THE MOBILE DELTA

Species	Harvest (pounds)[a]
Smallmouth Buffalo	257,350
Blue Catfish	116,334
Channel Catfish	94,040
Paddlefish	66,361
Gar	50,145
Flathead Catfish	18,215
Mullet	12,726
Fresh Water Drum	8,484
Other[b]	14,205
TOTAL	637,860

[a]Harvest from December 1980 to November 1981.

[b]Other includes boufin, carp, flounder, gizzard shad, redfish, shark, skate, speckled trout, and spot.

Source: Malvestuto et al., 1983.

TABLE 3-42

EARLY CHRONOLOGY OF COASTAL ALABAMA

1507	Mobile Bay outline on Waldseemueller map.
1559	Spanish settlement on Mobile Bay until 1561.
1699	Iberville establishes settlement on Dauphin Island.
1702	Bienville builds settlement at Fort Louis de la Mobile.
1711	Fort moved to present site of Mobile.
1763	Mobile ceded to Great Britian by Treaty of Paris.
1780	Mobile captured by Spanish forces.
1811	Mobile Centinel, Alabama Territory's first newspaper, published near Mount Vernon.
1813	Mobile recaptured from Spain.
1819	Alabama admitted into the Union as the 22nd state and Mobile granted city charter.

Source: Adapted from Walker, 1975.

Land marks and Heritage. Mobile contains several historic districts as well as individual structures. In 3 of these districts above, there are nearly 250 separate historic structures (Friend et al., 1982).

Jackson, Harrison and Hancock Counties, Mississippi

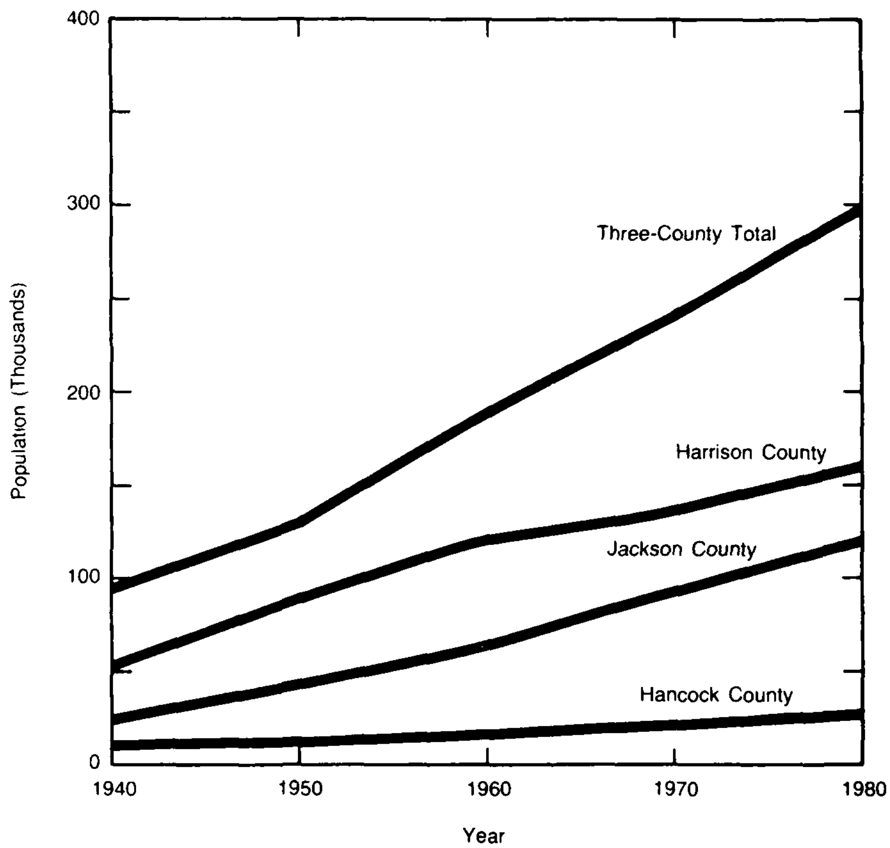
3.277 Characteristics of Mississippi's current socioeconomic environment which could be affected by offshore hydrocarbon development are described in this section. Accounts are given for the following socioeconomic features: population, personal income, labor force, employment, community services, land use, transportation, tourism and outdoor recreation, commercial fisheries and cultural resources.

Population

3.278 The 1980 population for Mississippi's three coastal counties was 24,496 for Hancock, 157,658 for Harrison and 118,015 for Jackson (U.S. Department of Commerce, 1982c). Each Mississippi coastal county experienced significant population gains during the last decade (Figure 3-23): 41.1, 17.2 and 34.1 percent respectively. Together the coastal area represents almost 12 percent of the State's population (Mississippi Research and Development Center, 1981b; Southern Mississippi Planning and Development District, 1980). In-migration has been a large factor in the coastal population increase but natural growth has been attributed as primarily responsible for the gains (Larson et al., 1980).

3.279 Mississippi's three coastal counties are divided into two SMSAs. The Pascagoula-Moss Point SMSA consists of Jackson County, while the Biloxi-Gulfport SMSA includes not only Hancock and Harrison counties, but Stone county adjacent to Harrison's northern border as well.

3.280 Three major cities are located in coastal Mississippi: Biloxi, Gulfport and Pascagoula. They are highly urban areas from the industrial and the resort sectors located in Harrison and Jackson counties (Southern Mississippi Planning and Development District, 1980). About 64 percent of the population in Harrison county and 50 percent in Jackson and Hancock counties live in urban areas. Harrison county has the largest population and highest density of 269.5 people per square mile. There are 160.3 people per square mile in Jackson and 50.9 in Hancock counties. (Mississippi Research and Development Center, 1982b).



Source: Mississippi Gulf Regional Planning Commission, 1971b; Mississippi Research and Development Center, 1983a

FIGURE 3-23
POPULATION IN HARRISON, JACKSON AND HANCOCK COUNTIES MISSISSIPPI FROM 1940 THROUGH 1980

3.281 Between 1960 and 1970 Jackson County had the most substantial population increase of the three counties (Figure 3-23). The Litton Shipbuilding facility in Pascagoula is cited as a major factor contributing to the county's growth. Population projections indicate that coastal Mississippi will continue to grow while many areas in the state are losing people (Southern Mississippi Planning and Development District, 1980). During the 1980's the most significant growth in the area is projected to occur in Jackson County (as it has in the past); however growth could slow during the 1990's. The other two counties are expected to experience more or less stable growth through the year 2000.

Personal Income

3.282 In 1980, total personal income in the Pascagoula - Moss Point and Biloxi-Gulfport SMSAs was $0.818 and $1.3 billion respectively (U.S. Department of Commerce, 1980b). Per capita personal income for the State of Mississippi, and the three coastal counties in 1970, 1975 and 1980 is shown by Table 3-43. Over time, Hancock County, the least populated and industrialized of the three, has had significantly lower per capita earnings than either of the other two counties or the state. Jackson and Harrison have had consistently higher per capita incomes than the State as a whole, but they remain between 73 and 88 percent of the national average.

3.283 The major sources of personal income for the three coastal counties are presented in Table 3-44. Both Hancock and Harrison counties rely to a greater degree on government for their incomes than does Jackson, where manufacturing contributes most to the economy. In Jackson County, however, a significant portion of the civilian employment in the area is dependent on federal contracts particularly in the shipbuilding industry (University of Southern Mississippi, 1977). Four major federal installations are located in Harrison: Keesler Air Force Base, the Naval Construction Battalion Center and two Veteran Administration hospitals (Larson et al., 1980).

3.284 Between 1980 and 2000 total personal income is projected to increase in all three coastal counties. Jackson county's income is expected to have the largest absolute gain with Harrison county closely approximating it. Hancock county is expected to lag behind in the absolute level of personal income (University of Southern Mississippi, 1977; National Planning Association, 1981).

Public Revenues from Oil and Gas Development

3.285 The state of Mississippi imposes a 6 percent severence tax on the gross value of oil and gas at the wellhead. Since July

TABLE 3-43

PER CAPITA PERSONAL INCOME FOR HANCOCK, HARRISON, JACKSON COUNTIES AND THE STATE OF MISSISSIPPI FOR 1970, 1975 and 1980

Area	Per Capita Income (dollars) 1970[a]	1975[a]	1980[b]	Percent Change 1970 - 1980
Hancock County	2,322	3,360	5,475	136
Harrison County	3,274	4,478	7,131	118
Jackson County	2,984	5,154	6,911	132
Mississippi[c]	2,547[c]	4,042[c]	6,508[c]	155

[a]Source: University of Southern Mississippi 1977.

[b]Source: Southern Mississippi Planning and Development District 1982b, based on Bureau of Economic Analysis, April, 1982.

[c]Source: Mississippi Research and Development Center 1981a; based on Bureau of Economic Analysis, May, 1981.

TABLE 3-44

PERSONAL INCOME BY MAJOR SOURCE FOR HANCOCK, HARRISON AND JACKSON COUNTIES, MISSISSIPPI IN 1974 AND 1980

	Percent of Income					
	Hancock County		Harrison County		Jackson County	
Income Source	1974[a]	1980[b]	1974[a]	1980[b]	1974[a]	1980[b]
Government	15.8	27.0	40.1	30.3	7.7	9.2
Manufacturing	3.1	13.9	5.9	-[d]	53.8	46.5
Transfer Payments	19.3	15.7	11.7	17.0	7.7	12.3
Wholesale & Retail Trade	8.0	-[d]	9.8	11.2	7.1	8.1
Services	-	15.8		9.5	-	-[d]
Dividends, Interest and Rent (includes property)	-	11.2	-	10.9	-	8.0
Other[c]	39.6	-	22.2	-	16.6	-
Property Income	14.0	-	10.2	-	7.1	-

[a]As reported by Southern Mississippi Planning and Development District, 1980.

[b]As reported by Mississippi Research and Development Center, 1983a.

[c]Includes services, finance insurance, real estate, mining, construction and other labor income, as reported for 1974 by Southern Mississippi Planning and Development District, 1980.

[d]Not reported by Mississippi Research and Development Center, 1983a.

1983 a maintenance tax of 2¢ per barrel of oil and 0.2¢ per 1,000 cubic feet of gas has also been collected (Haggy, 1983, Personal Communication; Bell, 1983, Personal Communication). The value of Mississippi gas produced in 1982 was $878 million, while oil production was valued at $1.14 billion (Bell, 1983 Personal Communication). Severence taxes collected that year on hydrocarbons produced in the state amounted to $52.7 million for gas, and $60.8 million for oil. In 1982, Hancock was the only hydrocarbon producing coastal county. Thirty-six producing wells yielded 166,000 barrels of oil and 11.5 billion cubic feet of gas there (Mississippi State Oil and Gas Board, 1983). Total statewide maintenance taxes collected on oil in the state amounted to about $287 thousand in 1982; for gas the total tax was approximately $173 thousand. The Mississippi Commission on Natural Resources held an offshore lease sale in July 1982, and accepted a bonus amount of over $3.2 million for state tract 57. The state leases awarded for the sale have yet to be developed, however, in the event production commences a royalty of 20 percent for oil, gas and sulfur would be collected by the state.

Labor Force

3.286 Annual estimates of the civilian labor force and the 1980 labor force participation rate are shown for the State of Mississippi and the three coastal counties (Table 3-45).

Employment

3.287 The three coastal counties have diverse employment characteristics. Among them, however, manufacturing and government emerge as the principal employment forces. Major sectors and associated employment for each of the three coastal counties is presented in Table 3-46. In Hancock County the major manufactured products are lumber and building components. Seafood, steel fabrication, machinery, marine products and apparel rank highest in Harrison. In Jackson County the manufacturing profile is dominated by shipbuilding, petrochemicals, marine products and seafood (Southern Mississippi Planning and Development District 1980). Jackson County has a large number of commuters from outside the county working within its bounds.

3.288 Although manufacturing and government are the most significant elements in the area's economy, other activities are also important such as commercial fishing, fish processing and tourism (U.S. Department of the Interior, 1982a). Travel-related sales from restaurants, hotels, and motels, for instance, exceeded $188 million along the Gulf Coast in 1981 (University of Southern Mississippi, 1982).

TABLE 3-45

ANNUAL AVERAGE LABOR FORCE ESTIMATES FOR 1980, 1981, AND 1982 FOR THE STATE OF MISSISSIPPI AND HANCOCK, HARRISON AND JACKSON COUNTIES

Area and Year	Labor Force[a] (thousands)	Labor Force Participation (percent)
Hancock County		
1980	9.0	50.4
1981	9.1	--
1982	9.4	--
1983	9.8	--
Harrison County		
1980	54	56.8
1981	54	--
1982	55	--
1983	57	--
Jackson County		
1980	45	62.6
1981	45	--
1982	47	--
1983	49	--
State of Mississippi		
1980	1,060	--
1981	1,055	--
1982	1,058	--
1983	1,068	--

[a] Civilian labor force, by place of residence.

Source: Mississippi Employment Security Commission, 1983a, 1984.

TABLE 3-46

NUMBER OF EMPLOYEES OF SELECTED INDUSTRY GROUPS
FOR THE STATE OF MISSISSIPPI, HANCOCK, HARRISON
AND JACKSON COUNTIES IN 1981

SIC[a] Code	Major Industry Group	NUMBER OF EMPLOYEES Hancock County	Harrison County	Jackson County	State Of Mississippi
	Agricultural Services, Forestry, Fisheries	0-19	89	20-99	3,528
--	Mining	0-19	16	20-99	10,212
13	Oil and Gas Extraction	b	b	b	8,881
131	Crude Petroleum and Natural Gas	b	b	b	1,645
132	Natural Gas Liquids	b	b	b	84
138	Oil and Gas Field Services	b	b	b	7,132
1381	Drilling Oil and Gas Wells	b	b	b	2,560
1382	Oil and Gas Exploration Services	b	b	b	735
1389	Oil and Gas Field Services, Nec.	b	b	b	3,637
--	Contract Construction	331	2,067	1,831	37,165
15	General Contractors & Operative Builders	b	894	333	10,181
16	Heavy Construction Contractors	100-249	334	430	10,000-24,999
17	Special Trade Contractors	75	839	1,068	14,552
--	Manufacturing	335	6,383	18,229	214,319
20	Food and Kindred Products	b	1,087	683	20,295
24	Lumber and Wood Products	b	70	118	22,853
26	Paper and Allied Products	b	b	1,000-2499	6,163
28	Chemicals and Allied Products	b	888	874	7,139
29	Petroleum and Coal Products	b	b	500-999	1,579
291	Petroleum Refining	b	b	500-999	1,000-2,499
373	Ship and Boat Building and Repair	100-249	b	10,000-24,999	15,833
--	Transportation & Other Public Utilities	230	3,341	898	35,177
44	Water Transportation	b	474	125	3,140
446	Water Transportation Services	b	500-999	20-99	454
49	Electric Gas & Sanitary Services	b	500-999	250-499	8,592
492	Gas Production and Distribution	b	20-99	b	1,877
--	Wholesale Trade	68	1,993	891	21,360
51	Wholesale Trade Nondurable Goods	b	500-999	250-499	18,150
517	Petroleum and Petroleum Products	b	220	73	3,217
--	Retail Trade	844	10,122	6,150	117,773
--	Finance, Insurance, Real Estate	193	2,450	1,064	33,666
--	Services	1,246	9,382	3,651	105,828

[a] SIC = Standard Industrial Classification.
[b] Group is not listed for county.
[c]Actual data are withheld in some cases to avoid disclosing figures for individual companies; employment ranges are given instead
Source: U.S. Department of Commerce, 1983b.

3.289 Pertinent industrial sectors potentially related to offshore resource development in coastal Mississippi include contract construction, petroleum refining, ship and boat building, water transportation, gas distribution and wholesale trade of petroleum products. Conspicuous by their absence are those occupations directly associated with oil and gas extraction (Table 3-46). This industry is not developed in coastal Mississippi as it is along the Alabama shore. However, some offshore oil and gas related employment is evident and trends indicate that given ideal conditions this sector could develop further. For instance, in Pascagoula, rig repair and construction activities have the potential of becoming more important (Pella, 1982). Two major employers in the county are involved in rig repair, Ingalls Shipbuilding and Chicago Bridge and Iron. Oil and gas infrastructure in the Pascagoula-Moss Point area includes two oil refineries and petroleum products plants (Garofalo 1982; Map B5). In the Gulfport area there is a pipe storage facility, three platform fabrication sites, and service bases involved in the oil and gas industry.

3.290 In 1976 there were fifteen identifiable Mississippi firms significantly involved in servicing offshore oil- and gas-related industries. Eight other firms identified could be related to the sector (Gladden et al, 1976). In all, these companies earned between $50 to $60 million in 1976. The number of firms and employees identified during the 1976 study are listed in Table 3-47.

Unemployment

3.291 Recent employment trends in the area have mirrored those of the country. Hancock County experienced employment declines in transportation and utilities, construction and finance, insurance and real estate between 1979 and 1981. Harrison County experienced declines in mining, construction and government during the same time. The job losses in construction, over 34 percent, were most significant. Overall manufacturing was down by about 20 percent in Jackson County between 1979 and 1981 at the same time there was a 5 percent decline in the labor force. As in the other two counties construction employment declined significantly, by about 23 percent. Table 3-48 contains unemployment statistics beginning in 1980.

Solid and Hazardous Waste

3.292 The Resource Conservation and Recovery Act (RCRA) specifically excludes drilling fluids and associated wastes from the hazardous waste category. Refuse associated with hydrocarbon activity is thus treated like any solid waste. Unlike Alabama, though, Mississippi has been delegated full authorization for

TABLE 3-47

EXISTING OCS OIL AND GAS RELATED ORGANIZATIONS IN COASTAL MISSISSIPPI FOR 1976

Industry Phase	Number of Firms	Number of Employees
Geophysical	1	50
Exploratory Drilling	1 (1)[a]	1,100
Platform Development	2	175
Oil and Gas Products	-	-
Crude Movement	-	-
Terminals, Refineries and Petrochemicals	1	500
Products Movement	2	340
Support Services and Related Activities	15	1,200
Identifiable Totals	23	3,365

[a]Has done work in the past, but was not engaged in the activity at the time of the survey.

Source: Gladden et al., 1976.

TABLE 3-48

UNEMPLOYMENT RATES (PERCENT) FOR COASTAL MISSISSIPPI FOR 1980 THROUGH 1983[a]

Year	Hancock County	Harrison County	Jackson County
1980	5.7	6.6	9.3
1981	6.8	7.0	9.2
1982	9.0	8.6	10.3
1983	13.7	12.2	19.9

Source: Mississippi Employment Security Commission, 1983a, 1984.

implementing the RCRA program. Additionally, the state has an approved coastal zone management program authorizing regulation over activities such as dredged material disposal and oil and gas exploration and development.

3.293 Regulatory Framework. The Mississippi Bureau of Pollution Control, Division of Solid Waste Management is responsible for the regulation of solid and hazardous wastes in the state. As in Alabama, the State Oil and Gas Board regulates underground injection wells related to the oil and gas industry, while the Coastal Zone Management Program is administered by the Bureau of Marine Resources.

3.294 In accordance with RCRA, wastes resulting from oil and gas activity are specifically excluded from the hazardous waste category. They are, however, solid wastes, the disposal of which is regulated by the Division of Solid Waste Management. Regulations prohibit anyone from engaging in handling, storage, or disposal of solid wastes or sludge unless authorized by a State permit. Regulated activities include sanitary landfills, solid waste processing facilities, storage facilities and landfarming. No one may begin construction or operation of any facility engaged in these activities without both construction and operating permits. Construction permit requirements assure that the facility is designed and constructed in compliance with appropriate solid waste control specifications. Upon certification, an operating permit is used for the life of the facility, but may be suspended or revoked for failure to comply with permit requirements. No specific permitting requirements are indicated for the disposal of wastes from oil and gas operations.

3.295 Under Rule OS-8 of the Mississippi State Oil and Gas Board, requirements are placed on drillers to prevent pollution of state waters from offshore drilling operations. The regulations prohibit the disposal of oil, liquid waste materials, muds, detergents, surfactants, dispersants, and other wastes into the water. All solid waste materials are required to be incinerated or transported to shore for disposal.

3.296 The Coastal Zone Management Program in Mississippi is administered by the Department of Wildlife Conservation, Bureau of Marine Resources. Regulation of the coastal area is largely based on the Mississippi Coastal Wetlands Protection Law (as amended 1979 and 1980) and the Mississippi Marine Resources Council Enabling Legislation. Regulated activities include channels and canals, dredged material disposal and oil and gas exploration and development.

3.297 <u>Waste Handling Practices and Disposal Facilities in Coastal Mississippi</u>. The Mississippi Pollution Control Board, Department of Solid Waste Management requires EP toxicity tests on treated drilling wastes prior to disposal. Tests are run on new sources of the wastes and on each chemical or physical change in the muds. Reports are submitted within ten days of an alteration, and analytical reports are required monthly. Several firms within coastal Mississippi treat and or dispose of drilling wastes (Table 3-49). Dewatering is necessary and the treated liquids are discharged under NPDES permit while solids are transported to landfills.

3.298 Disposal Systems, Inc. treats and disposes of wastes from oil and gas activity. The treatment facility is served by a barge docking area, drying beds, storage lagoons and a wastewater treatment plant while the 84 acre disposal site is located 7.5 miles inland. The firm has NPDES permits for the liquid discharges. It has been estimated that the facility has the capacity to accept wastes from 230 more wells (Phillips, 1983).

3.299 Mississippi Pumping Services in Hancock County has been under contract with Superior Oil and their operation in the Mobile Delta. Only freshwater muds are treated at Mississippi Pumping. They have their own disposal site which encompasses about 160 acres and is used exclusively for drilling wastes. Newpark Waste Treatment and Landfarming, Inc. in Jackson County are in the process of obtaining permits necessary for mud treatment and disposal. Newpark is associated with the treatment end of the business and is not yet fully permitted, while Landfarming is involved in disposal.

3.300 Browning-Ferris Industries of Jackson County, Mississippi has in the past and is currently accepting drilling muds at their 70 acre Class A Sanitary Landfill. The wastes must be solid, already treated, and certified as non-hazardous. They are buried with other solid wastes normally accepted. Treated wastes from Resource Consultants, Inc. in Alabama, for instance, are disposed of at the Browning-Ferris landfill.

3.301 Permit records of the State of Mississippi Department of Natural Resources, Bureau of Pollution Control Division of Solid Waste Management, indicate that five landfill sites are fully permitted and authorized to accept wastes in Hancock, Harrison and Jackson Counties. Only the Browning-Ferris Industries Site in Jackson County, however, is permitted to accept and has received treated oil drilling muds.

3.302 Drilling wastes treated in the vicinity may be disposed of outside the project area. For instance, Exxon has barged its

TABLE 3-49

EXISTING DRILLING MUD AND CUTTINGS TREATMENT AND/OR DISPOSAL COMPANIES IN HANCOCK, HARRISON AND JACKSON COUNTIES, MISSISSIPPI

Company	Treatment Process
Disposal Systems, Inc. Biloxi, MS	Dewatering/sedimentation/discharge liquids landfill solids
Mississippi Plumbing Services Kiln, MS	Dewatering/sedimentation/landfill
Newpark Waste Treatment, Inc. Metairie, LA	Dewatering/landfill solids
Landfarming, Inc. Jackson County, MS	Subsoil System - injection into land applications
Browning-Ferris Industries Pascagoula and Ocean Springs, MS	Accepts only treated non-hazardous waste into normal landfill operations

solid and liquid drilling wastes from its Mobile Bay operation to Chemical Waste Management Company in Port Arthur, Texas, where slurries of mud and cuttings are mixed with cement dust to produce a tillable product which is landfilled (about 25,000 cubic yards of solid volume in the landfill per well). Liquid wastes are injected into deep wells.

Transportation

3.303 The regional transportation system includes roads and highways, railroads, airports, waterways and port facilities. Coastal Mississippi is characterized by well developed roadways. Interstate 10 and U.S. 90 are the major routes serving the coastal area. They are parallel to one another along the coast, linking the major urban centers (Figure 3-20, end of chapter).

3.304 In Mississippi, major highways have a weight limit of 73,280 pounds, while interstate highways limit loads to 80,000 pounds and secondary roads restrict them above 57,650 pounds (Mississippi Research and Development Center, 1981b). The state maximum load limitations are lower than federal limits. This reportedly has kept out-of-state carriers away from Mississippi adversely affecting the ports of the region (Southern Mississippi Planning and Development District, 1980).

3.305 Railroad service in the coastal region is provided by four lines. The Louisville and Nashville (L&N) parallels the east-west corridor of U.S. 90 from Mobile through Pascagoula, Ocean Springs, Biloxi, Gulfport, Long Beach, and Bay St. Louis (Figure 3-20, end of chapter). North-south access is also available to ports in the area.

3.306 Utilities. There is one electrical power plant in Harrison County and one planned for Jackson (Mississippi Research and Development Center, 1981b). Several rural electric power associations purchase electricity from the principal organization to supply rural customers. There are a two electricity suppliers in Hancock, two in Harrison and one in Jackson. Natural gas is the most commonly used fuel in Mississippi (Southern Mississippi Planning and Development District, 1980). There are two major suppliers in the area while several local gas distributors serve customers directly.

3.307 Port Facilities and Waterways. There are five major ports along coastal Mississippi and a commercial harbor at Pass Christian. The largest port is at Pascagoula in Jackson County, it has two harbors. The State Port at Gulfport in Harrison County ranks second followed by three smaller ports, Port Bienville in

Hancock, Biloxi and Pass Christian located in Harrison (Southern-Mississippi Planning and Development District, 1980). Additionally, the following locations have been designated Special Management Areas (SMAs) through the Mississippi Coastal Program (Mississippi Department of Wildlife Conservation and U.S. Department of Commerce, 1980a):

- o Port Bienville Industrial Park
- o Pass Christian Industrial Park
- o Bayou Bernard Industrial Park
- o Pascagoula River
- o Bayou Casotte Industrial Area
- o Proposed Moss Point Industrial Park

It is likely that some of these waterway facilities, particularly those along the eastern Mississippi coast, would be used as support and service industry staging grounds associated with hydrocarbon development in the event increased activity results in the region. Total tons, ton-miles and the number of vessel trips made within Mississippi's coastal waterways in 1981 are given in Table 3-50. The channels provide access for deep-draft vessels from the Gulf (Larson et al., 1980).

3.308 The Port of Pascagoula is highly industrial. The two harbors are: the Pascagoula River Harbor (West Harbor) and the Bayou Casotte Harbor (East Harbor). The Port has immediate access to railroads, the intercoastal waterway and the interstate highway system. Additionally, master plans call for deepening the channel to 50 feet.

3.309 The state-owned Port at Gulfport is not as industrial as is the Pascagoula port (Duke, 1983), but it is expanding in size and showing yearly increases in tonnage handled. It is entirely man-made and has two piers separated by a 1,320 foot wide turning basin. The harbor depth is 30 feet. This port is 15 miles from the deepwater Gulf shipping lines and rail service provides access from the port north, east and west.

3.310 Port Bienville in Hancock county includes an adjacent 2,400 acre industrial park. It has 4,400 feet of 16-foot barge channel and 20,800 feet of 12 feet deep barge channel. There is also a 150 foot concrete warf, transit storage and unlimited outside storage associated with the industrial park. It is located five

TABLE 3-50

WATERBORNE TRAFFIC IN COASTAL MISSISSIPPI IN 1981

Harbor Or Waterway	Total Commodities, Domestic (Short Tons, Millions)	Total Ton-Miles (Millions)	Average Haul Per Ton (Miles)	Number Of Vessel Trips, 1981			
				Direction	Trips Per Direction	Direction	Trips Per Direction
Gulf Intracoastal Waterway Mobile Bay, AL to New Orleans, LA	1.7	1,740	100.3	EASTBOUND	3,826	WESTBOUND	3,945
Pascagoula Harbor, MS[a] Bayou Casotte, MS	26.4	183	7	INBOUND	6,699	OUTBOUND	6,513
Biloxi Harbor, MS	1.3	16	12.3	INBOUND	3,833	OUTBOUND	3,848
Gulfport Harbor[c]	1.1	23	29	INBOUND	1,356	OUTBOUND	1,357

[a]Section includes lower 4 miles of Dog River, 3.8 miles of Pascagoula River, Mississippi Sound, Bayou Casotte, and Horn Island Pass Channels.

[b]Section includes Mississippi Sound, Biloxi Bay, Back Bay and land cut to Gulfport Lake.

[c]Section Includes Mississippi Sound Channel, Ship Island Pass Channel and Small Craft Harbor.

Source: U.S. Army Corps of Engineers, 1983a.

miles from the Gulfport Channel and 30 miles from the Gulf outlet. The facility has its own rail system which connects with the L&N (Southern Mississippi Planning and Development District, 1980).

3.311 Biloxi harbor has a 12 foot deep navigation channel; it is used primarily by commercial fishing vessels, tug and barge traffic (Mississippi Department of Wildlife Conservation, Bureau of Marine Resources, 1982). The only commercial docking facilities exist at the Harrison County Industrial Seaway which primarily deals with coal and lignite traffic. This facility has access to railroads, the intercoastal waterways and interstate highways (Southern Mississippi Planning and Development District, 1980). The Regional Transportation Management Plan for outer continental shelf oil and gas development (federal waters) cites the first three ports mentioned above as currently capable of or could be expanded to receive petroleum hydrocarbons transported by barge or ship (U.S. Department of the Interior, 1981b).

3.312 The Intracoastal Waterway traverses the entire Mississippi Sound in an east-west direction (Figure 3-20, end of chapter). It serves as a major collection route for goods funneled through feeder waterways (Larson et al. 1980). Offshore Safety Fairways lie in the open Gulf south of the offshore barrier islands and serve as major traffic lanes for large sea going ships crossing the northern Gulf on their way to the channels leading to inland ports.

Land Use

3.313 A regional land use survey conducted by the Mississippi Gulf Regional Planning Commission in 1969 and 1972 serves as the basis for determining trends in land use activity for the three coastal counties (Hode, 1976). The change in economic base from forestry and fishing to manufacturing and services is particularly evident in the change of land use along the Mississippi coast. The coastline has become increasingly urbanized, but in both Harrison and Jackson counties forest land still comprises a signficant portion of the area (Table 3-51). Agricultural land in all three counties represents only 5 to 6 percent of the land used.

3.314 Land Use in Hancock, Harrison and Jackson Counties. Over a third of Hancock County's total acreage (307,882 acres) is federal land devoted to the National Space Technologies Laboratory and military installations (Larson et al., 1980). Another third has little development (Hode, 1976).

3.315 In 1972 forested land represented over 40 percent of land used in Harrison County. Of total forest land, the Desoto National Forest accounts for just over one-third, commercial forests

TABLE 3-51

1972 LAND USE IN HANCOCK, HARRISON, AND JACKSON COUNTIES, MISSISSIPPI

Land Use	Area (acres) Hancock County	Harrison County	Jackson County	Total	Percent of Total Area
Residential	3,982	14,239	11,403	29,624	2.6
Commercial	239	1,434	938	2,611	0.2
Industrial	4,628	2,389	5,182	12,199	1.1
Public	1,525	5,367	6,401	13,293	1.2
Rights-of-Way	7,042	10,193	10,407	27,642	2.4
Resource Production (i.e. Forestry)	60,795	187,449	178,230	426,474	37.0
NASA - Military	103,856	2,802	0	106,658	9.2
Water	5,388	18,277	13,712	37,377	3.2
Unclassified	120,455	130,190	239,613	497,258	43.1
TOTAL	307,910	372,340	465,886	1,153,136	100.0

Source: Larson et al., 1980 from the Gulf Regional Planning Commission.

comprise the remainder (Larson et al., 1980). Two military installations are important to the area. Keesler Air Force Base, and the Naval Construction Battalion Center in Gulfport (Larson et al., 1980). Between 1969 and 1972, commercial lands increased more rapidly than anticipated in Harrison (Hode, 1976). Due to the addition of the Long Beach Industrial Park, industrial land use in the county increased by 15 percent.

3.316 Jackson County has experienced rapid growth over the last several years. During World War II Ingalls Shipyard was constructed at Pascagoula which led to a county industrialization program that improved park facilities and created the large industrial park at Bayou Casotte (Larson et al., 1980).

3.317 Coastal Land Use. The Mississippi Gulf coast shoreline is about 248 miles long. Land use is marked by a diversity of a highly developed mainland on Mississippi Sound and a generally undeveloped shoreline on the barrier islands facing the Gulf. Very few boundaries remain between communities on the coast where the high density urban corridor is relatively continuous and in part a result of the tourism industry (U.S. Department of the Interior, 1981c, 1982a). The mainland area consists of marsh areas and artificially maintained beaches. The offshore barrier islands are separated from the mainland by Mississippi Sound. All except Cat Island have beaches on the Gulf and Sound Sides. The total shoreline of the islands is about 33 miles; 27 miles of which is beach.

3.318 Beach shoreline in Mississippi is about 39 percent of the total length. Public recreation accounts for 32 miles of the coast while 106 miles are used for private recreation, 9 miles for non-recreational development and 101 miles are undeveloped. Of the total coast the federal government owns about 13 percent, the state owns 17 percent, and the remainder is private land (U.S. Department of the Interior, 1981c).

Tourism and Outdoor Recreation

3.319 The Mississippi Coastal area has a rich array of recreational resources, including beaches, State Parks, the Gulf Island National Seashore, the Desoto National Forest (inland), several lakes, three wildlife management areas, fishing camps and piers, charter boats, golf courses and more (Figure 3-21 and Figure 3-22, end of chapter). Activities associated with the major natural and man-made recreational attractions include swimming, snorkeling, sunbathing, sightseeing, golf, hunting, fishing and boating. Acreage for major recreational resources in each county is shown in Table 3-52.

TABLE 3-52

MAJOR RECREATION RESOURCES ALONG THE MISSISSIPPI COAST

County	Beaches (Acres)		Boating/ Skiing (Acres)		Marina *Slips*		Big Game Hunting (Acres)		Small Game Hunting (Acres)		Waterfowl Hunting (Acres)	
	Public	Non-Pub.	Public	Non-Pub.	Public	Non-Pub.	Public	Non-Pub.	Public	Non-Pub.	Public	Non-Pub.
Hancock	23	1	0	0	24	171	0	0	25	0	0	2
Harrison	328	154	9	0	347	64	61,361	0	61,311	70	207	0
Jackson	300	17	34,734	30	178	977	119,201	20	119,201	30	700	30
Total	651	172	34,743	30	549	1,212	180,562	20	180,537	100	907	32

Source: Mississippi Park Commission and Mississippi Research and Development Center, 1976.

3.320 The annual calendar of events along the coast begins with Mardi Gras in February. Throughout the year residents and travelers participate in many seasonal occasions, some examples are:

- o Mardis Gras
- o Landing of D'Iberville, at Ocean Springs
- o South Mississippi Festival of Arts in Pascagoula
- o Moss Point River Jamboree at Moss Point
- o Miss U.S.A. Pageant
- o Bass Tournament at Indian Point, Gautier
- o Excursions to Ship Island from Biloxi
- o Blessing of the Fleet at Biloxi
- o Gautier Jaycees Fishing Rodeo
- o Sailing Regattas
- o Gulf Coast Fishing Rodeo at Gulfport
- o Labor Day Celebrations in Pascagoula
- o South Mississippi, Gumbo Festival at Necaise Crossing,
- o Octoberfest in Biloxi

3.321 Harrison County serves as the center of the coast's outdoor activities and claims 85 percent of the tourist trade (U.S. Department of the Interior, 1982a) with its 26 mile man-made beach as the focal point. Biloxi has the largest percentage of beach use (Larson et al., 1980). In all, coastal Mississippi has more than 5,500 motel/hotel rooms (Mississippi Department of Economic Development, undated). The Mississippi Gulf Goast Lodging Industry concludes from a survey that for every dollar spent for lodging about two more are spent for related goods and services (Mississippi Department of Wildlife Conservation, Bureau of Marine Resources, 1982). Based on this, hotel/motel sales generated in 1981 could have resulted in more than $140 million in overall sales. Selected travel-related sales for each county along the Gulf coast for 1981 and the first two quarters of 1982 are indicated by Table 3-53.

3.322 Gulf Island National Seashore. The barrier islands within the Gulf Island National Seashore collectively provide over 1,800 acres of seaside and soundside sunbathing, snorkeling and sightseeing resources (Larson et al., 1980; Mississippi Department of Wildlife Conservation, ~~Bureau of~~ Marine Resources, 1982). Including the Islands, over 9,000 acres are in the Park (Jackson County Planning Commission, 1979). In 1981 visitors to the National

TABLE 3-53

SELECTED TRAVEL-RELATED SALES FOR THE MISSISSIPPI GULF COAST BY COUNTY, BY QUARTER FOR 1981 and 1982

County	Restaurant Sales (Thousands of $) 1981	Restaurant Sales (Thousands of $) 1982	Hotel-Motel Sales (Thousands of $) 1981	Hotel-Motel Sales (Thousands of $) 1982
Hancock				
1st Qtr	1,701	2,315	243	488
2nd Qtr	2,429	2,820	429	473
3rd Qtr	2,455		708	
4th Qtr	2,353		440	
Total	8,404		1,820	
Harrison				
1st Qtr	17,256	19,509	7,941	8,916
2nd Qtr	26,097	27,389	10,664	14,233
3rd Qtr	23,669		12,523	
4th Qtr	19,007		6,672	
Total	86,029		37,800	
Jackson				
1st Qtr	10,086	11,617	1,595	1,964
2nd Qtr	12,849	14,093	2,004	1,899
3rd Qtr	12,595		1,778	
4th Qtr	11,920		1,836	
Total	47,450		7,213	
Gulf Coast				
1st Qtr	29,043	33,440	9,780	11,368
2nd Qtr	41,374	44,302	13,097	16,604
3rd Qtr	38,719		15,009	
4th Qtr	33,280		8,948	
Total	142,416		46,834	

Source: University of Southern Mississippi, 1982 from Mississippi State Tax Commission.

Seashore, including Horn, Ship and Petit Bois Islands and the Davis Bayou Camp in Ocean Springs, exceeded 600,000 (University of Southern Mississippi, 1982). Two of the islands, Horn and Petit Bois, are designated wilderness areas.

3.323 Water Based Recreation. Two-thirds of the State's marinas, one fourth of the boat launching ramps and 90 percent of the beaches are on the Gulf Coast. Salt water activities dominate the water related recreation with freshwater fishing boating and water skiing ranking second on the list of preferences (Larson et al., 1980). The region has at least 60 marinas and 104 launching ramps (Larson et al., 1980). In addition to these boating facilities there were 36 charter boats available for coastal salt water fishing trips in 1978 (Mississippi Alabama Sea Grant Consortium, 1978). Over 21,000 boats were registered in the three coastal counties in 1981; by 1982 this number increased by about 20 percent (Mississippi Department of Wildlife Conservation, Bureau of Marine Resources, 1983). Within Mississippi Sound there are 34,700 acres of water available for boating and waterskiing.(Mississippi Park Commission and Mississippi Research and Development Center, 1976).

3.324 Recreational Fishing. The Mississippi Bureau of Marine Resources estimates that about $25 million are spent annually on marine sportsfishing for private and rental boat trips, charter trips, wadefishing and fishing from piers and jetties. In addition to this sum another $8.6 million is used for capital expenditures yielding $33.6 million. Applying a 1.3 economic multiplier to the total (Mississippi Department of Wildlife Conservation, Bureau of Marine Resources, 1982) an annual valve of $43.7 million results. The Bureau estimates that the total annual value of recreational marine fishing is over $43.7 million (Mississippi Department of Wildlife Conservation, Bureau of Marine Resources 1982).

3.325 Both freshwater and saltwater fishing along the coast can be enjoyed year round. Freshwater yields include bass, white perch, bream (Mississippi Department of Economic Development, undated) and catfish. Between January and December 1979 an estimated 155,000 individuals participated in Mississippi recreational marine fishing (U.S. Department of Commerce, 1980a). Of the total most (88,000) participants were from the coastal area while 52,000 originated out of state and 15,000 were from non-coastal areas. In all, 640,000 fishing trips were made, 79 percent of which were made by coastal residents. Most of the recreational fish are caught beyond the three mile limit (Table 3-54) (U.S. Department of Commerce, 1980a).

3.326 Public Access. Several shorefront access areas are designated Special Management Areas (SMA's) by the Mississippi

TABLE 3-54

ESTIMATED WEIGHT (THOUSAND KILOGRAMS) OF FISH CAUGHT[a] BY MARINE RECREATIONAL FISHERMEN BY AREA OF FISHING AND MODE FOR THE GULF OF MEXICO REGION

Mode	Ocean, More Than 3 Miles	Ocean, 3 Miles Or Less	Inland	Unknown	Total
Man-Made Structures[b]	none reported	888	190	1,148	2,226
Beach/Bank	none reported	432	644	161	1,236
Party/Charter	244	none reported	69	1,391	1,703
Private/Rental	7,384	1,122	5,359	3,124	16,989
Total	7,628	2,442	6,262	5,824	19,928

[a]Fish brought ashore, available for identification, weighing and measuring.

[b]Such as piers, jetties, bridges and causeways.

Source: U.S. Department of Commerce, 1980a.

Coastal Zone Management Program. The purpose of these designations is to insure that the coastal water resources will be readily available to the public. The availability of beaches, although important, is a minor concern compared to water access for boating, fishing and the visual enjoyment of the waterfront (Mississippi Department of Wildlife Conservation and U.S. Department of Commerce, 1980a). The major shorefront access areas along the coast include four beaches (Harrison County, Bay St. Louis-Waveland, Ocean Springs, and Pascagoula) and Deer Island. In addition to the many boat launches at SMA's private and commercial marinas also provide access to the coastal waters.

Commercial Fisheries

3.327 The commercial marine fisheries are an important factor in the economy of Mississippi's coastal area. Although some 30 species were landed commercially, 3 of these (shrimp, menhaden, and red snapper) accounted for 95 percent of the 1980 and 1981 landings valued at nearly $30 million at dockside in 1981 (Southeast Fisheries Center, 1982a). The top fish and shellfish species (Table 3-55) accounted for better than 99 percent of the total landings. The relatively poor contributions of oysters to the total landings particularly in 1980, reflects the destructive effects of excess fresh water from 1979 spring flooding of the Mississippi River system and also, to some extent, the effects of Hurricane Frederic in the fall of 1979. Data for 1982 indicate a comeback for oysters, with over $2 million in landings during the year (U.S. National Marine Fisheries Service, 1983).

3.328 The landings include species taken in the state waters of Mississippi Sound and those taken in the open waters of the Gulf of Mexico. Shrimp are taken in the Sound and in the Gulf while red snapper are taken on the banks in the Gulf near the edge of the continental shelf. However, almost all of the commercial species are dependent on the shallow estuarine areas, particularly during their early life-stages. The protection and maintenance of such areas is a key factor in coastal fisheries management.

3.329 Of the various commercial species in Mississippi Sound, oysters are the most geographically concentrated, confined to certain reef areas in various parts of the Sound. Mississippi has about 5,000 acres of oyster reefs, concentrated primarily in the 4,000-acre Square Handkerchief Reef complex in the western part of the Sound (Mississippi Department of Wildlife Conservation, Bureau of Marine Resources, 1982). Figure 3-14 (end of chapter) shows the location of these oyster reefs and other commercial fisheries features of the area.

TABLE 3-55

COMMERCIAL MARINE FISHERIES LANDINGS IN MISSISSIPPI

Species	1981 Landings (dollars)	1980 Landings (dollars)
SHELLFISH		
Shrimp	15,818,665	17,535,445
Blue Crab	518,666	692,905
Oysters	472,729	21,994[a]
Subtotal	16,810,060	18,250,344
FISH		
Menhaden	8,617,512	11,465,311
Red Snapper	1,205,089	943,512
Black Drum	218,366	365,066
Croaker	179,897	68,685
Black Mullet	167,495	224,661
Pompano	135,404	127,776
Other[b]	227,078	166,069
Subtotal	10,750,841	13,361,080
GRAND TOTAL	27,560,901	31,611,424

[a]The low dollar volume in 1980 reflects the effects of 1979 spring floods and of Hurricane Frederick in the fall of 1979.

[b]Other includes: bluefish, blue runner, crevalle, red drum, flounder, grouper, king whiting, moonfish, sea catfish, spotted sea trout, white sea trout, shark, spanish mackeral, spanish sardine, spot, squid, swordfish, tilefish, tripletail, and tuna.

Source: Southeast Fisheries Center, 1982a.

Cultural Resources

3.330 The Mississippi coastal area contains a large number of anchaeological and historical sites associated with the various peoples and events of the state's past. The following paragraphs present a summary discussion of these resources.

3.331 Archaeological Resources. Just as with the Alabama coastal area, the rich natural resources of the Mississippi coastal area were a primary focal point for many prehistoric inhabitants of the area. The Mississippi Department of Archives and History has indentified a number of prehistoric sites, including shell middens, mounds, dwellings and village sites (Mississippi Department of History and Archives, 1982; Mississippi Department of Wildlife Conservation, Bureau of Marine Resources, 1982; Walker, 1983). Because of the potential looting of sites that can occur with the publication of specific site data, the exact locations and individual descriptions of known archaeological sites have been omitted from this report.

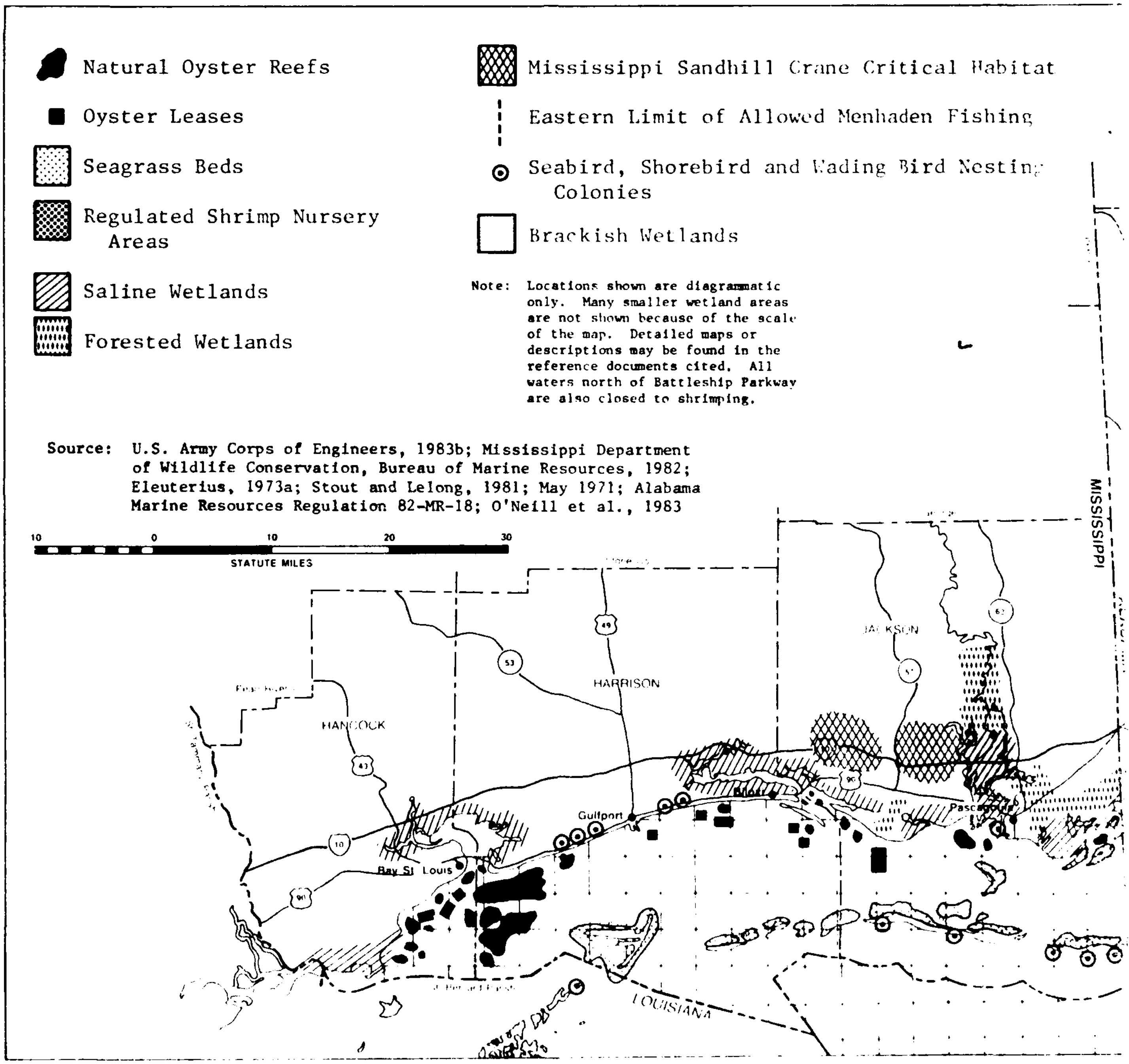
3.332 Historical Resources. The historical associations of the area range from the earliest explorers of the Gulf area through to more recent events. Table 3-56 present a brief chronology of early events in coastal Mississippi. Historical resources in the area include important historic buildings and historic districts, fort sites, cemetaries, lighthouses and sunken vessels. The Statewide Survey of Historic Sites has identified a vast number of potentially significant historic structures and sites (Mississippi Department of Archives and History, 1982). These historical resources include many diverse items. The Rotten Bayou Cemetary in Bay St. Louis dates from the 1700's and is one of the oldest on the Gulf. In Biloxi, there is an 1807 Creole plantation cottage while located in Ocean Springs is the site of the 1699 Fort Maurepas, the first fort on the Gulf.

TABLE 3-56

EARLY CHRONOLOGY OF COASTAL MISSISSIPPI

1665	Charles II extends grant to Clarendon, Carteret and others to include what is now coastal Mississippi.
1699	Pierre le Moyne establishes settlement of Fort de Maurepas on Bay of Biloxi. Area now Ocean Springs.
1718	French company grants land for settlement on Bay of St. Louis and Pascagoula Bay.
1723	Seat of government of Louisiana moved from Biloxi to New Orleans.
1763	After French and Indian War, area becomes English province (as part of West Florida).
1782	In Treaty of Paris following Revolutionary War, Spain receives southern Mississippi as part of West Florida.
1810	U.S. annexes West Florida from Spain.
1812	Hancock and Jackson Counties established.
1814	Naval battle of Pass Christian fought near St. Louis Bay.
1817	Mississippi admitted to the Union as the 20th state.

Source: Adapted from Vexler, 1978 and Federal Writer's Project, 1938.



Natural Oyster Reefs
Oyster Leases
Seagrass Beds
Regulated Shrimp Nursery Areas
Saline Wetlands
Forested Wetlands
Mississippi Sandhill Crane Critical Habitat
Eastern Limit of Allowed Menhaden Fishing
Seabird, Shorebird and Wading Bird Nesting Colonies
Brackish Wetlands
Note: Locations shown are diagrammatic only. Many smaller wetland areas are not shown because of the scale of the map. Detailed maps or descriptions may be found in the reference documents cited. All waters north of Battleship Parkway are also closed to shrimping.
Source: U.S. Army Corps of Engineers, 1983b; Mississippi Department of Wildlife Conservation, Bureau of Marine Resources, 1982; Eleuterius, 1973a; Stout and Lelong, 1981; May 1971; Alabama Marine Resources Regulation 82-MR-18; O'Neill et al., 1983
10 0 10 20 30
STATUTE MILES
HANCOCK
HARRISON
Gulfport
Bay St Louis
LOUISIANA
MISSISSIPPI

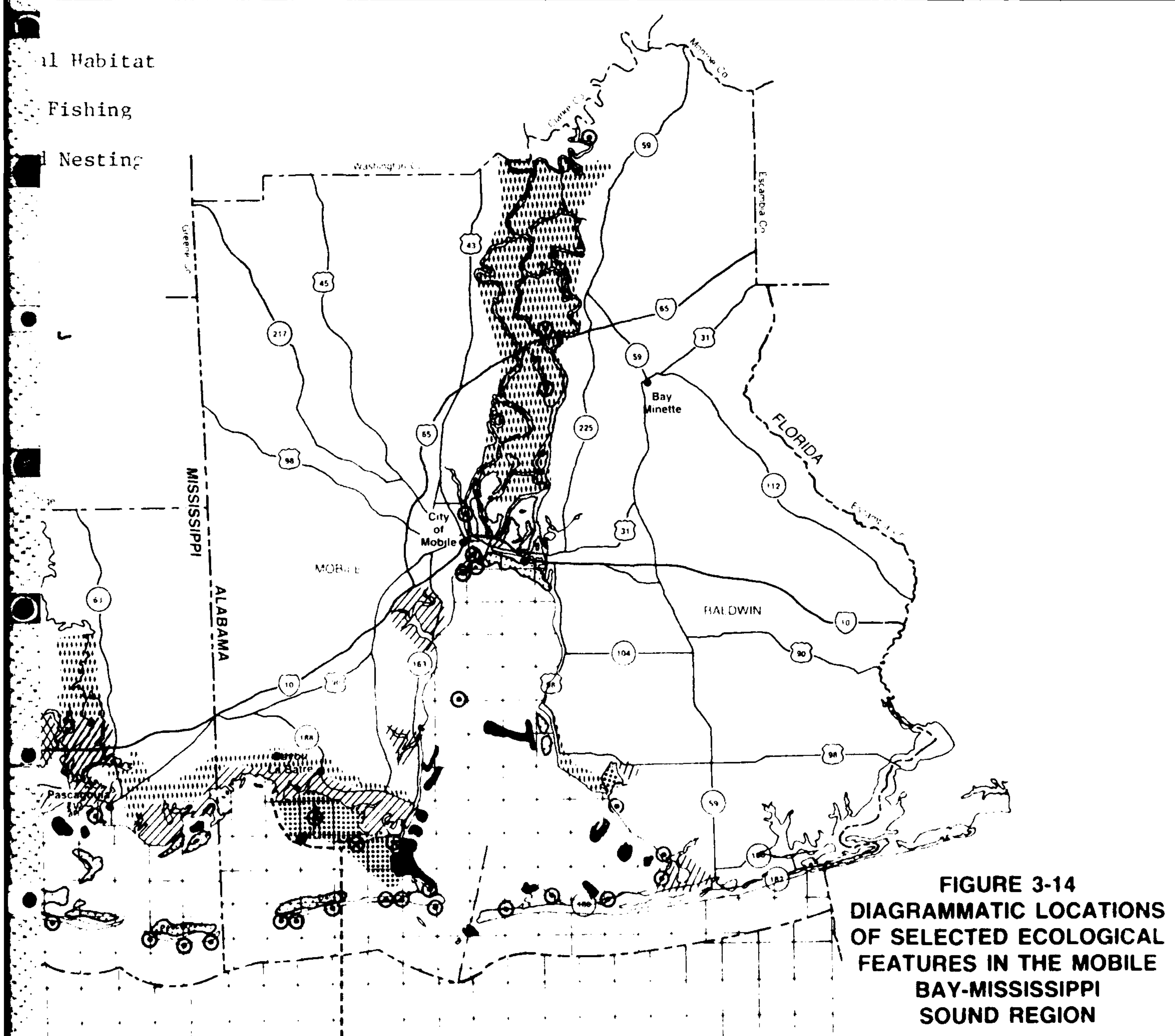


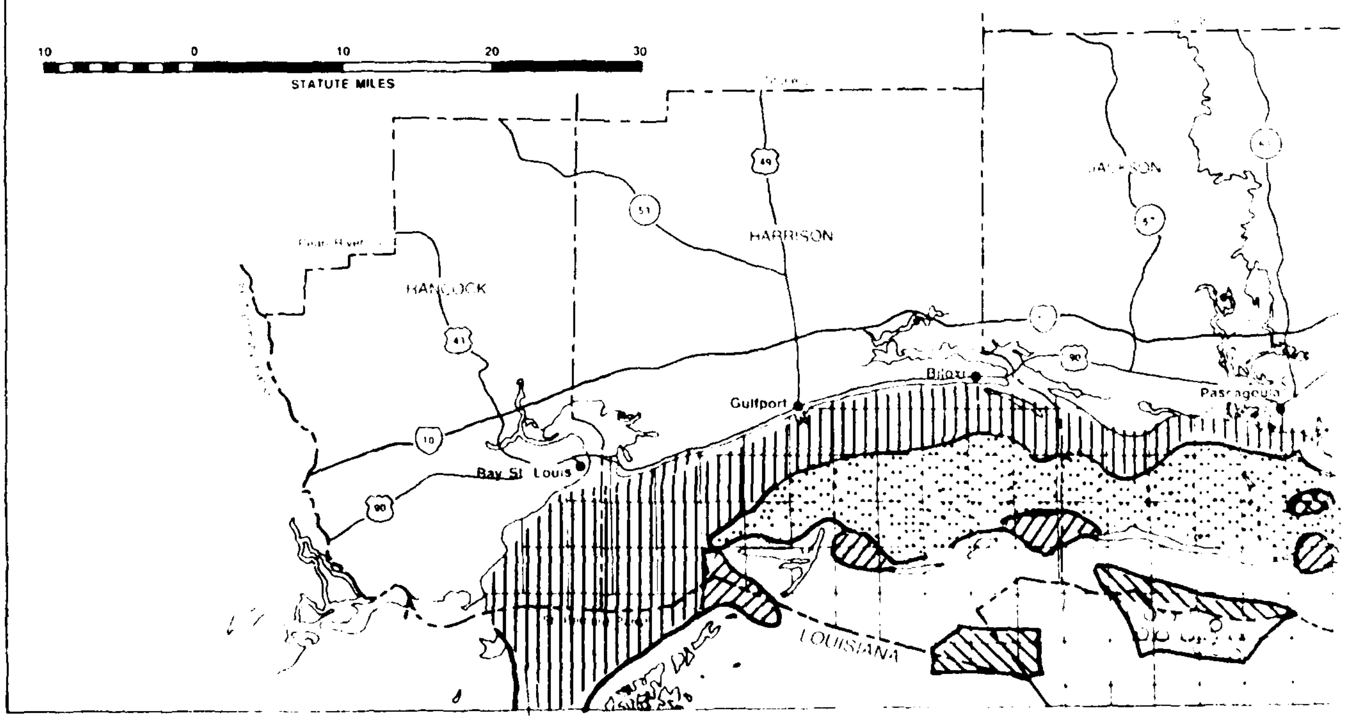
FIGURE 3-14
DIAGRAMMATIC LOCATIONS OF SELECTED ECOLOGICAL FEATURES IN THE MOBILE BAY-MISSISSIPPI SOUND REGION

MISSISSIPPI SOUND AND MOBILE BAY
- Coastal Margin (mud)
- Lower Mobile Bay (mud)
- Open Sound (muddy sand)
- Tidal Pass (clean sand)
- Shallow Sound (clean sand)

GULF OF MEXICO
- Mud Bottom
- Muddy Sand Bottom
- Clean Sand Bottom

Blank areas indicate no data in source cited.

Source: Barry A. Vittor and Associates, Inc., 1982



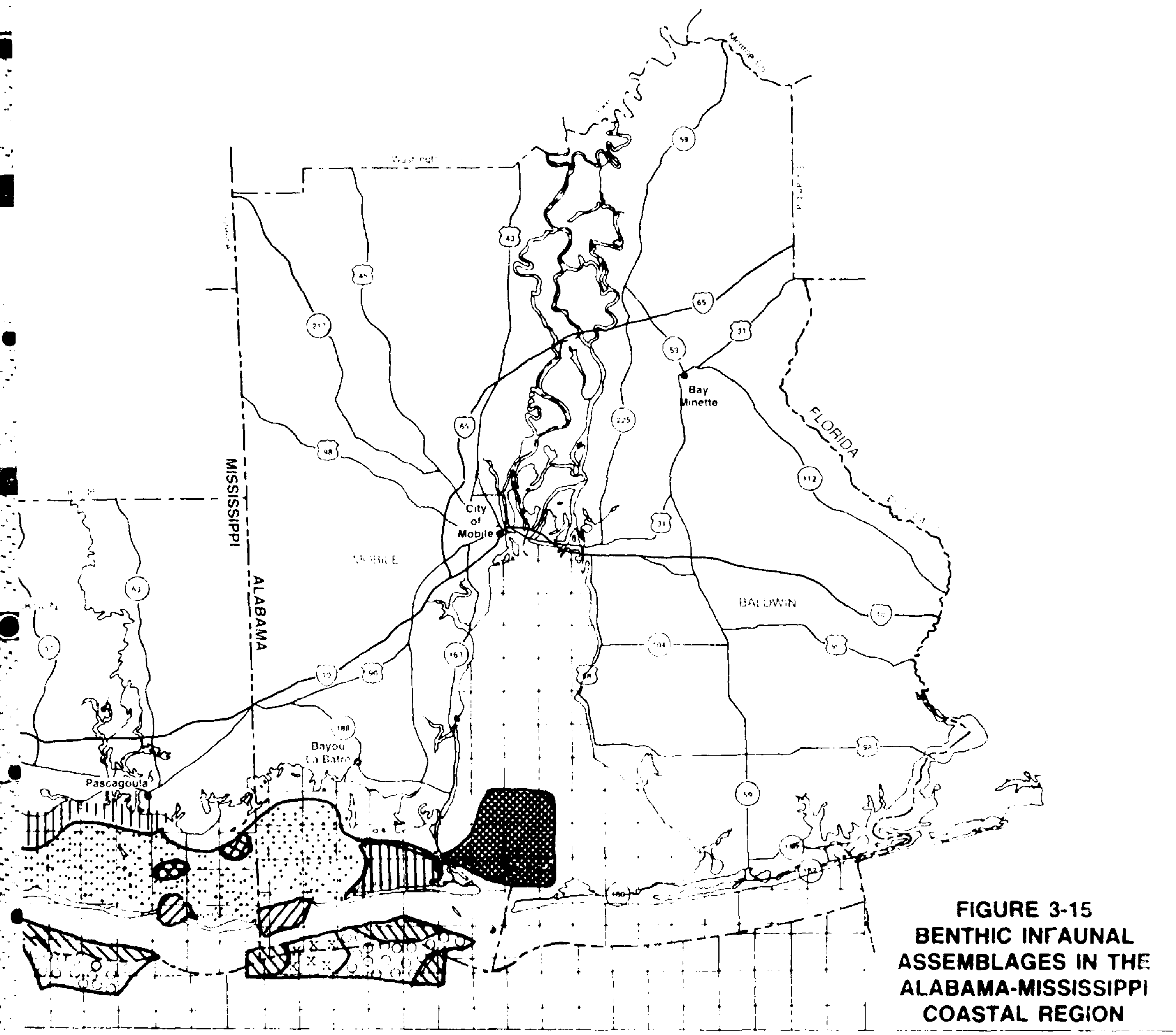
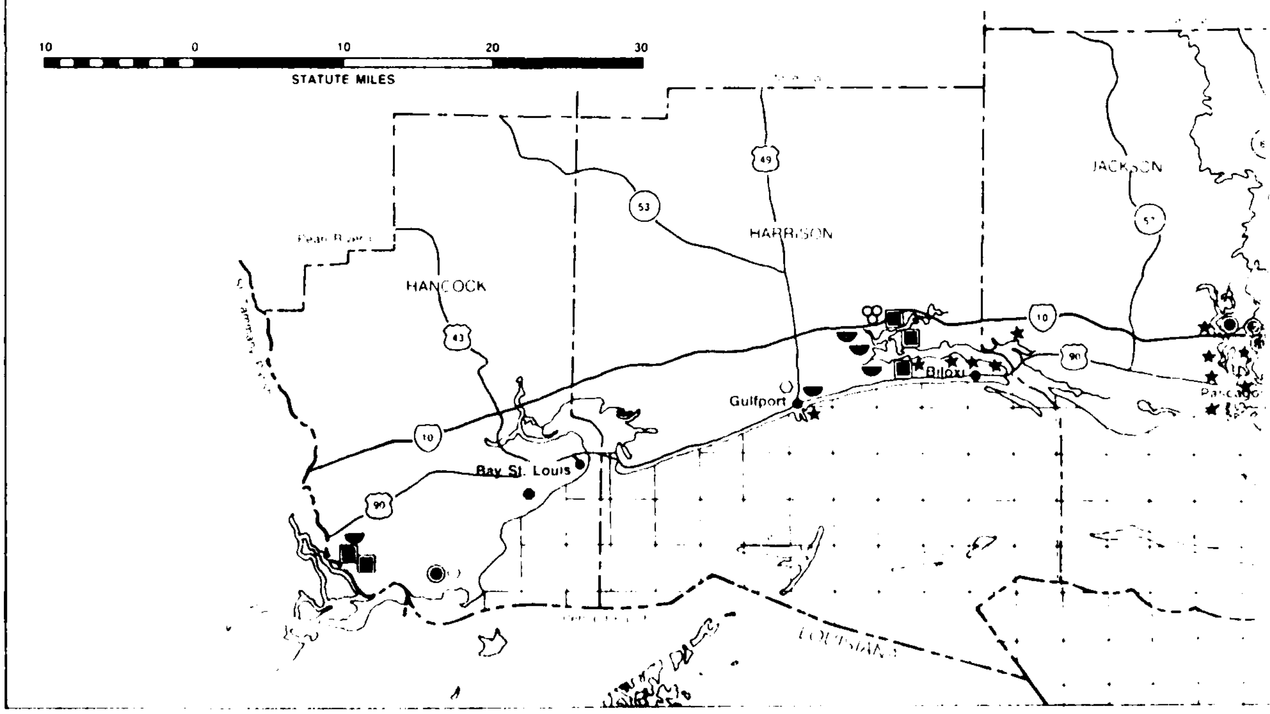


**FIGURE 3-15
BENTHIC INFAUNAL
ASSEMBLAGES IN THE
ALABAMA-MISSISSIPPI
COASTAL REGION**

* Shipyard
▲ Refinery
● Processing Plant
■ Rig Construction/Repair
■ Platform Fabrication Site
Service/Supply Base
◉ Other Petroleum Products Plant
o Oil Storage Facility
Pipe Storage Facility

Source: U.S. Department of the Interior, 1982b;
Garfalo, 1982; Bolin and Masingill, 1983.



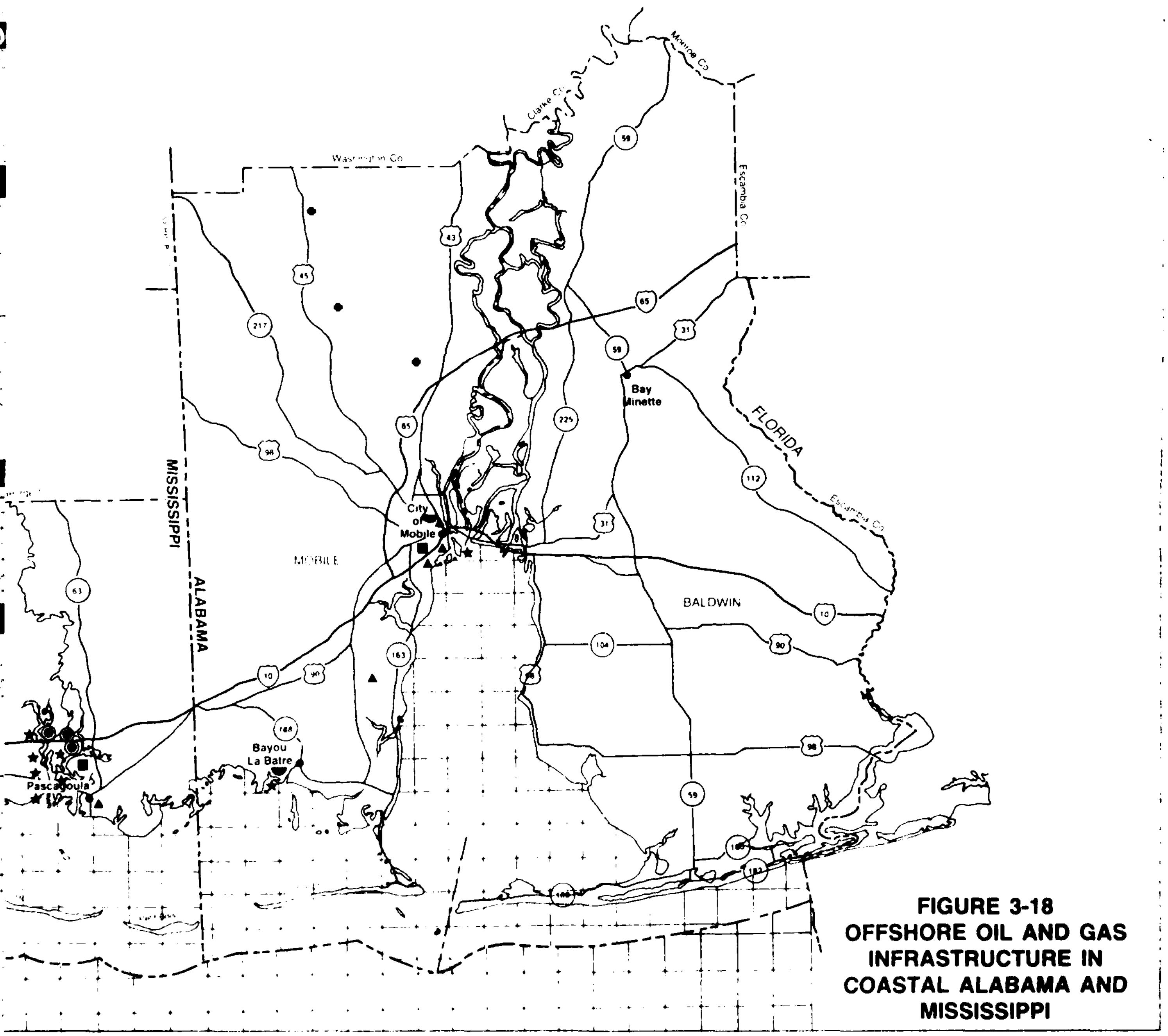
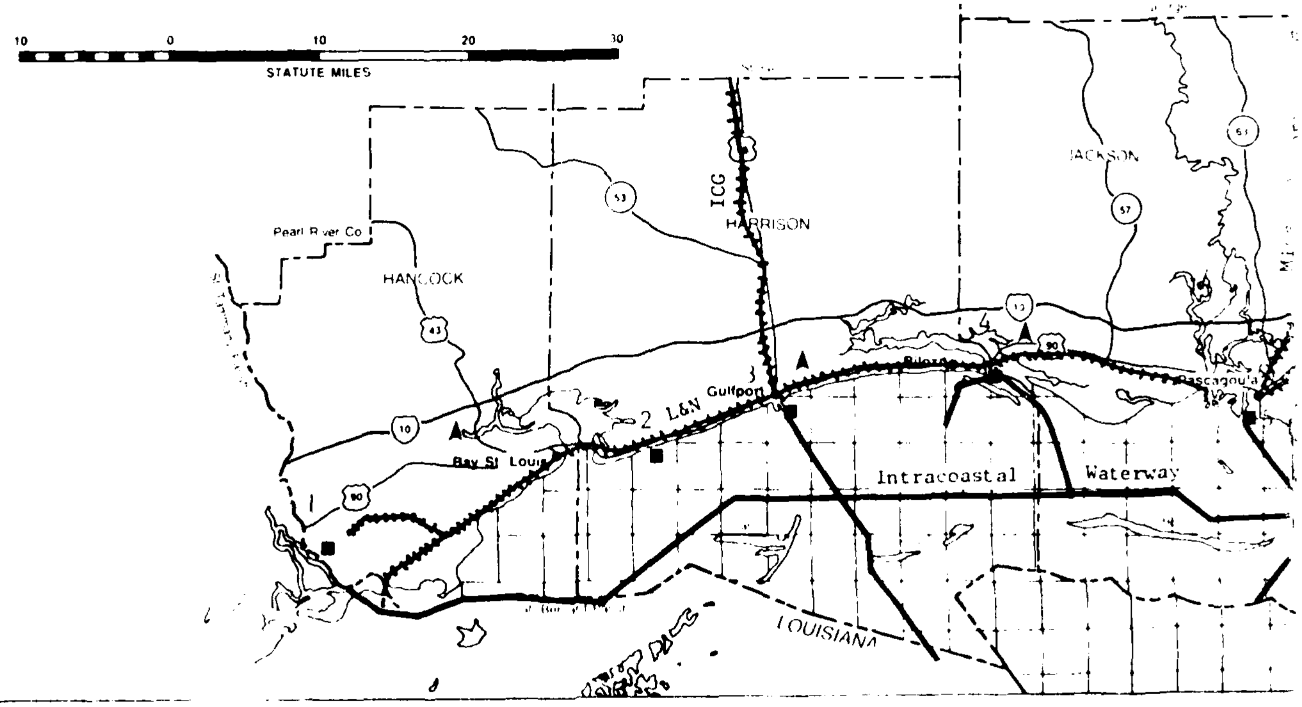


FIGURE 3-18 OFFSHORE OIL AND GAS INFRASTRUCTURE IN COASTAL ALABAMA AND MISSISSIPPI

1 Port Bienville
2 Pass Christian Harbor
3 State Port at Gulfport
4 Biloxi Harbor
5 Port of Pascagoula
6 Port of Bayou Cassotte
7 Port of Bayou La Batre
8 Bayou Coden
9 Theodore Industrial Park
10 Port of Mobile
11 Port of Chickasaw
12 Bon Secour

▲ Airport
Railroad
Interstate Highway
State Highway
Maintained Waterway Channel
U.S. Highway
■ Port

Source: Southern Mississippi Planning and Development District, 1980; South Alabama Regional Planning Commission, 1981a; Garfalo, 1982.



1980;

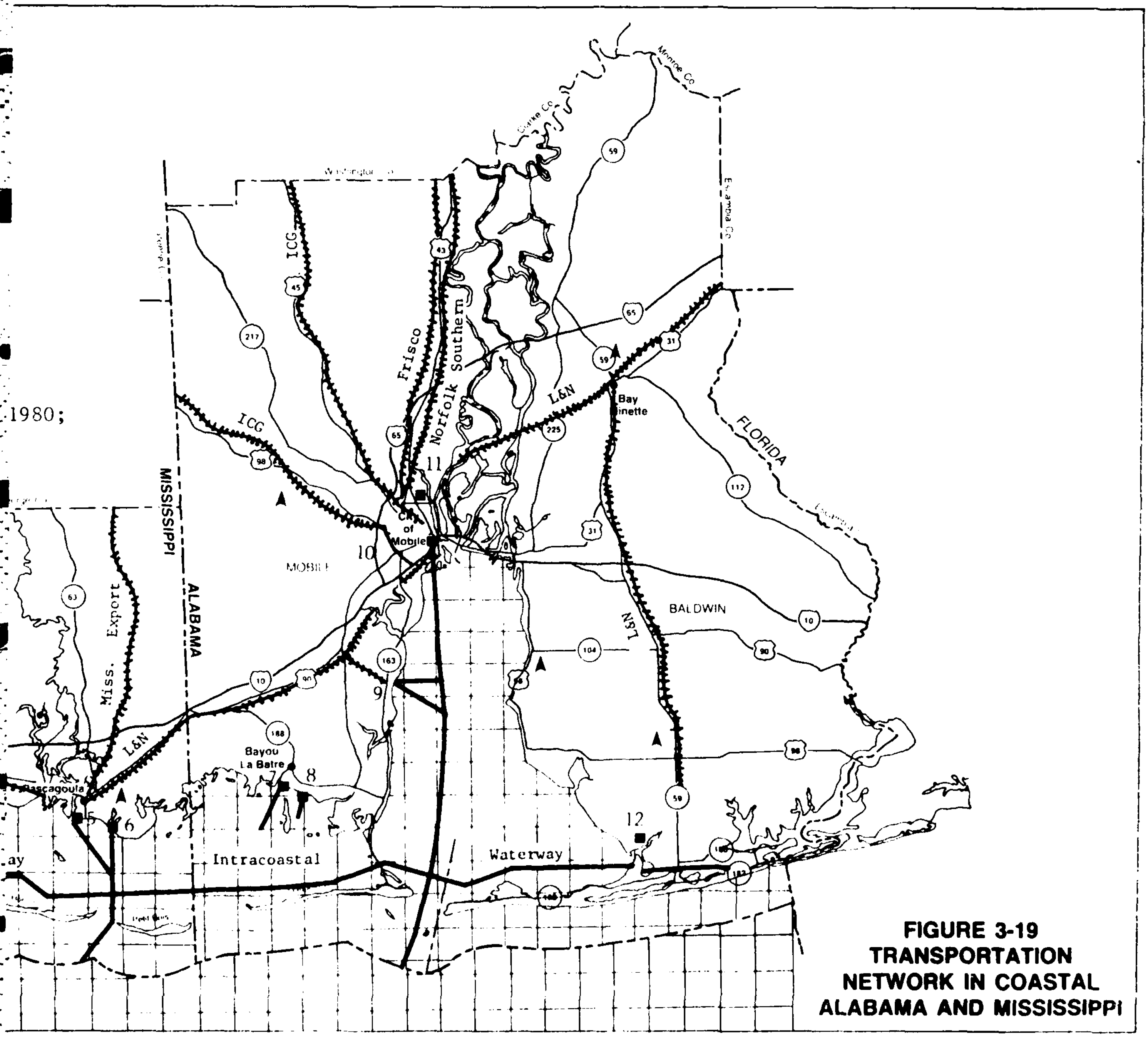
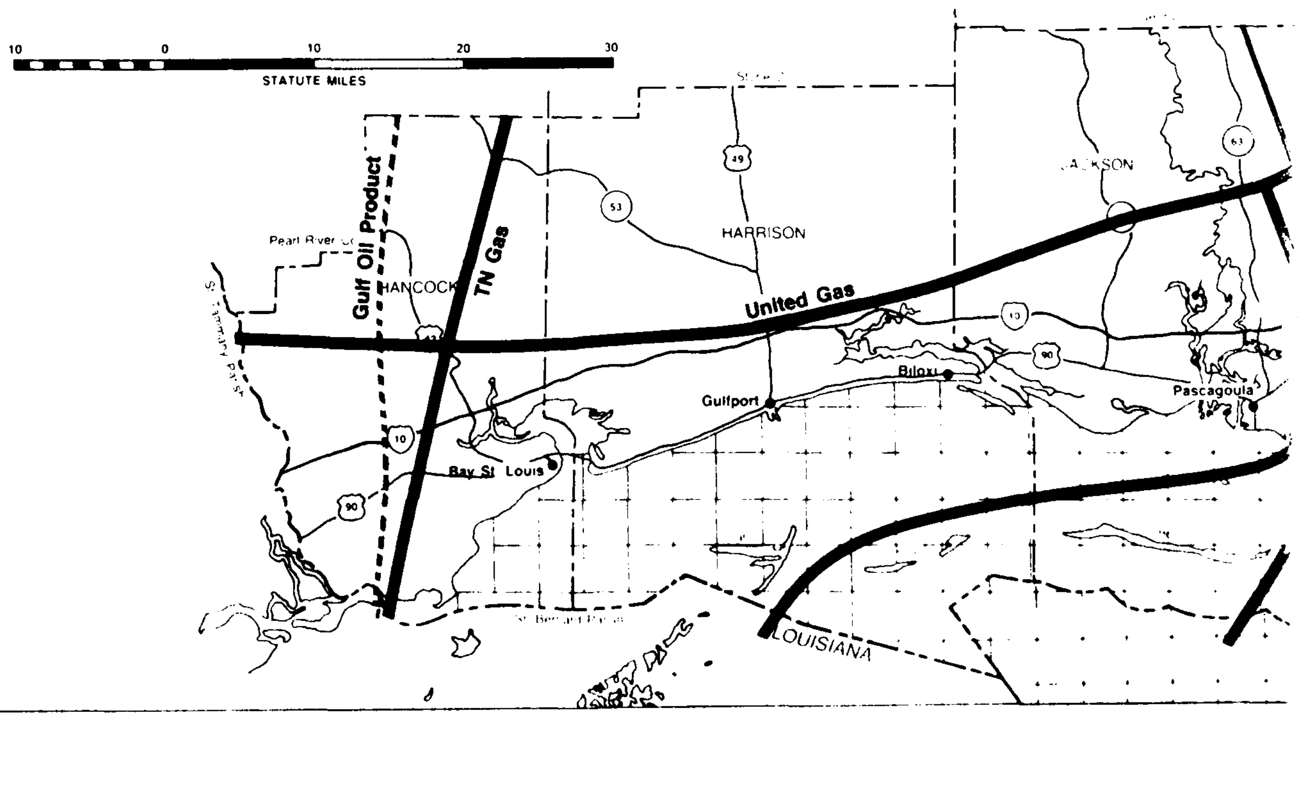


**FIGURE 3-19
TRANSPORTATION
NETWORK IN COASTAL
ALABAMA AND MISSISSIPPI**

Gas Transmission Pipeline
Crude Oil Pipeline
Petroleum Products Pipeline

Source: Mississippi Department of Wildlife Conservation, Bureau of Marine Resourses 1982; Bolin and Masingill 1983.[a]

[a]The Alabama Oil and Gas Board is in the process of revising their pipeline systems map.



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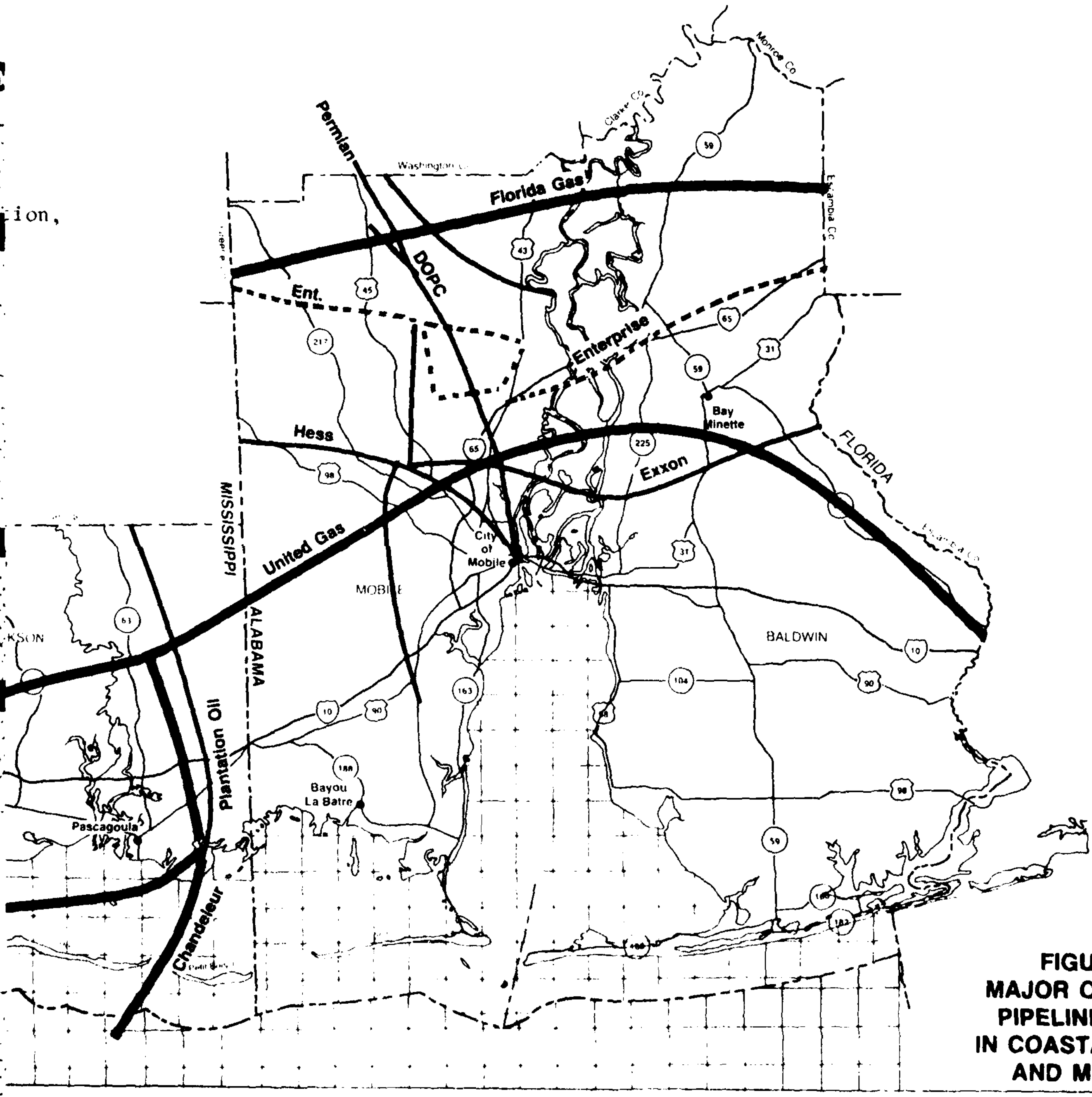


FIGURE 3-20
MAJOR OIL AND GAS PIPELINE SYSTEMS IN COASTAL ALABAMA AND MISSISSIPPI

2

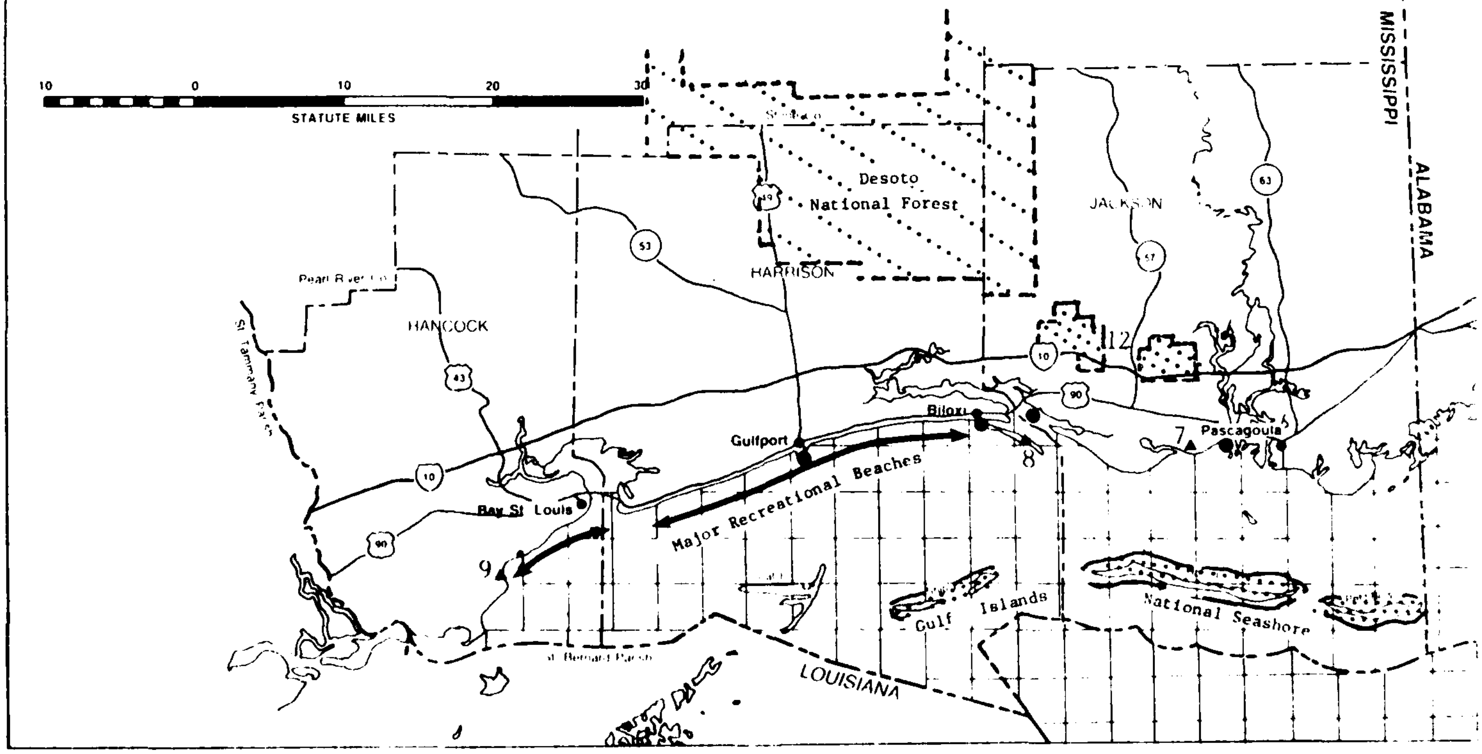
▲ State and Local Recreation Areas

1 Meaher State Park
2 Gulf State Park
3 Fort Morgan
4 Fort Gaines
5 Bellingrath Gardens
6 Point Aux Pins
7 Shepherd Park
8 Gulf Marine State Park
9 Buccaneer State Park
10 Mobile Bay
11 Battleship Memorial Park
12 Mississippi Sandhill Crane Wildlife Refuge
13 Bon Secour National Wildlife Rufuge
14 Audubon Bird Sanctuary
15 Nature Conservancy
16 Weeks Bay is Being Considered for National Estuarine Sanctuary Status

⁚⁚⁚ National Forest, Refuge or Landmark
● Charterboat/Headboat Fleet
⟷ Major Recreational Beaches

[a]The Existence and Location of a Natural Landmark Should be Considered by Federal Agencies when They Assess the Effects of Their Actions on the Environment.

Sources: U.S. Dept. of the Interior, 1982a, 1983h; Friend et al., 1983; Garofalo, 1982; Miss. Park Commission and Research and Development Center, 1976; South Alabama Regional Planning Commission, 1981c; Larson et al., 1980; Miss. State Highway Dept., 1982; Miss. Dept. of Wildlife Conservation, Bureau of Marine Resources and U.S. Dept. of Commerce, 1980a.



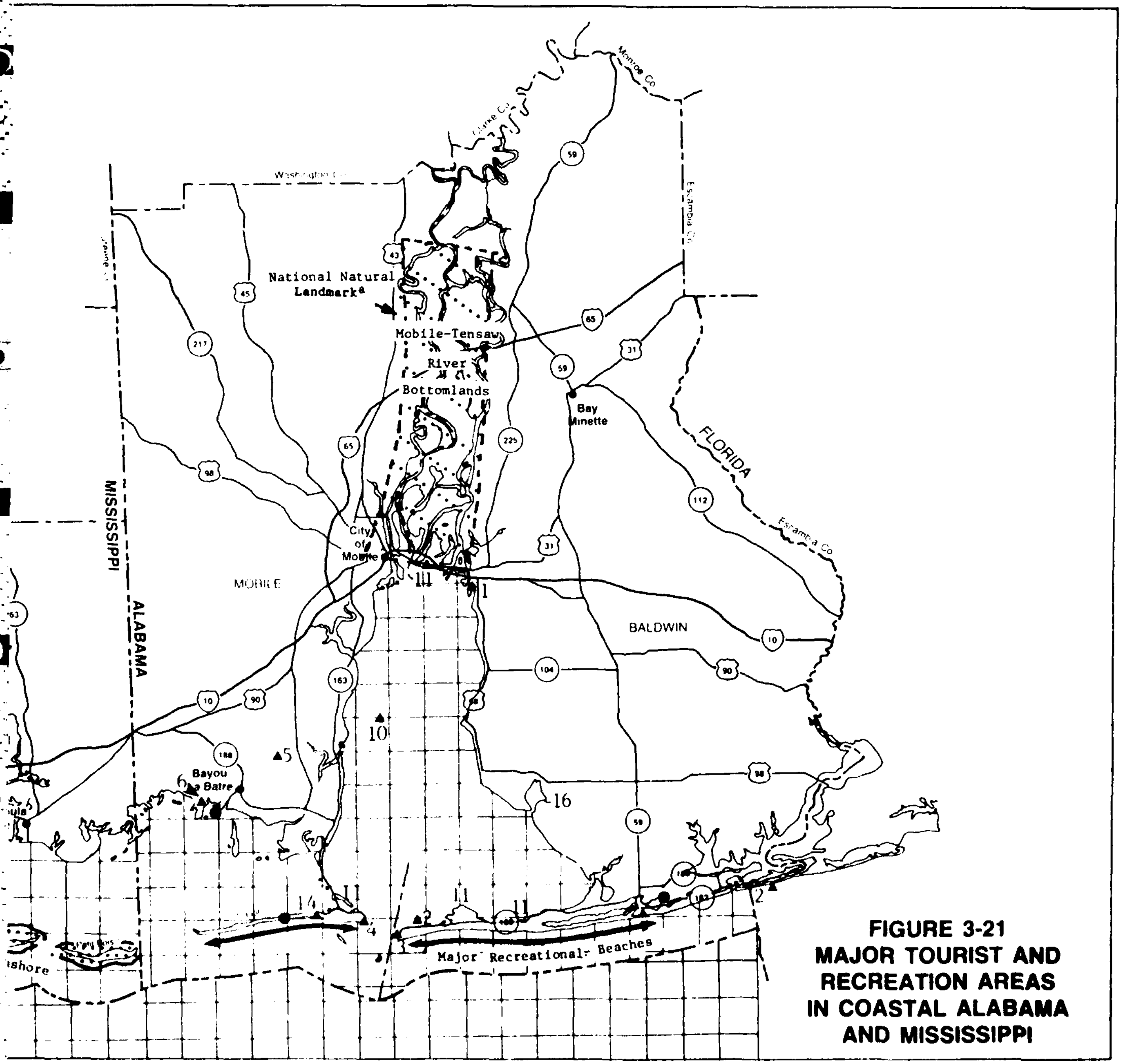
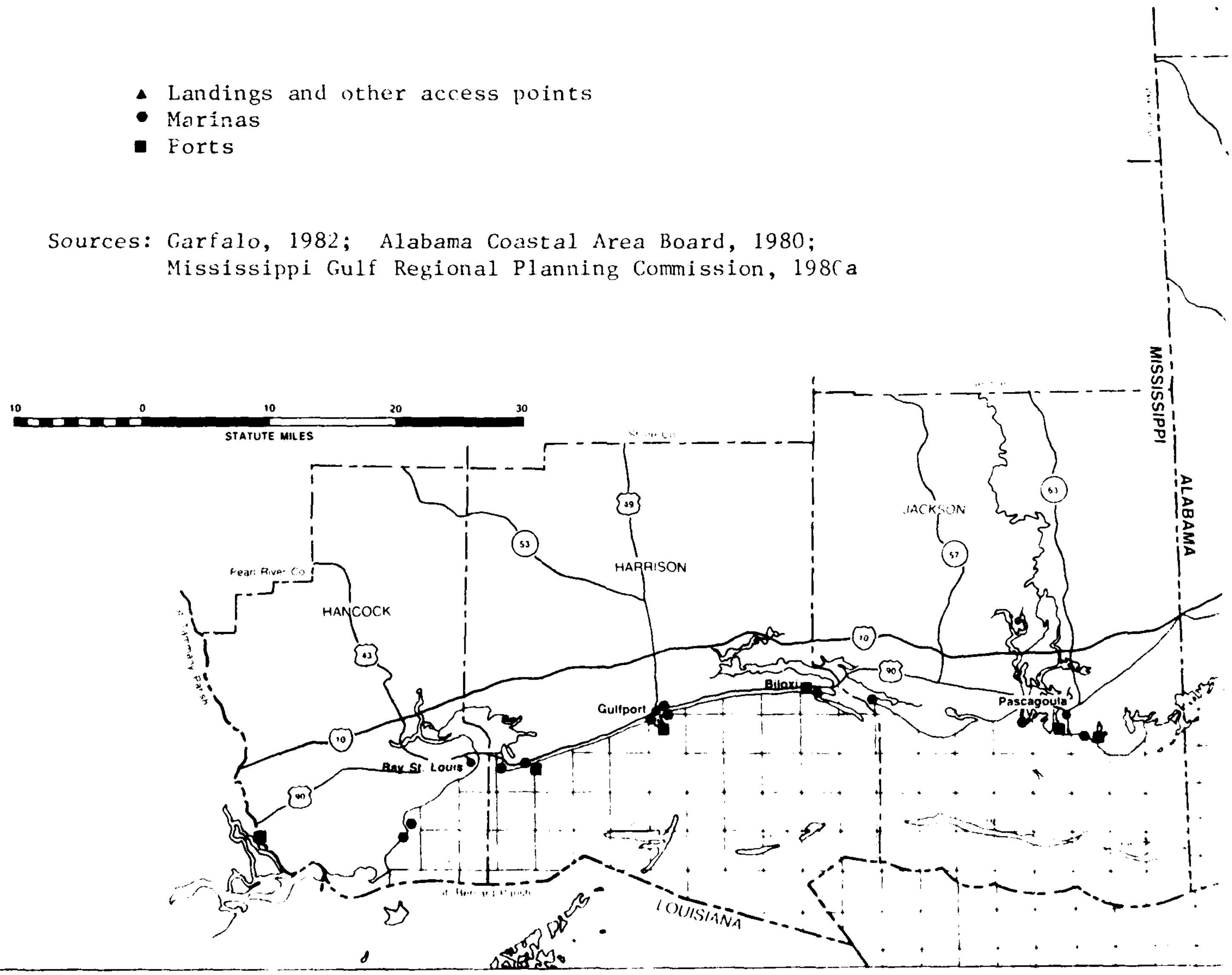


FIGURE 3-21
MAJOR TOURIST AND RECREATION AREAS IN COASTAL ALABAMA AND MISSISSIPPI

2

▲ Landings and other access points
● Marinas
■ Forts

Sources: Garfalo, 1982; Alabama Coastal Area Board, 1980;
Mississippi Gulf Regional Planning Commission, 198(a



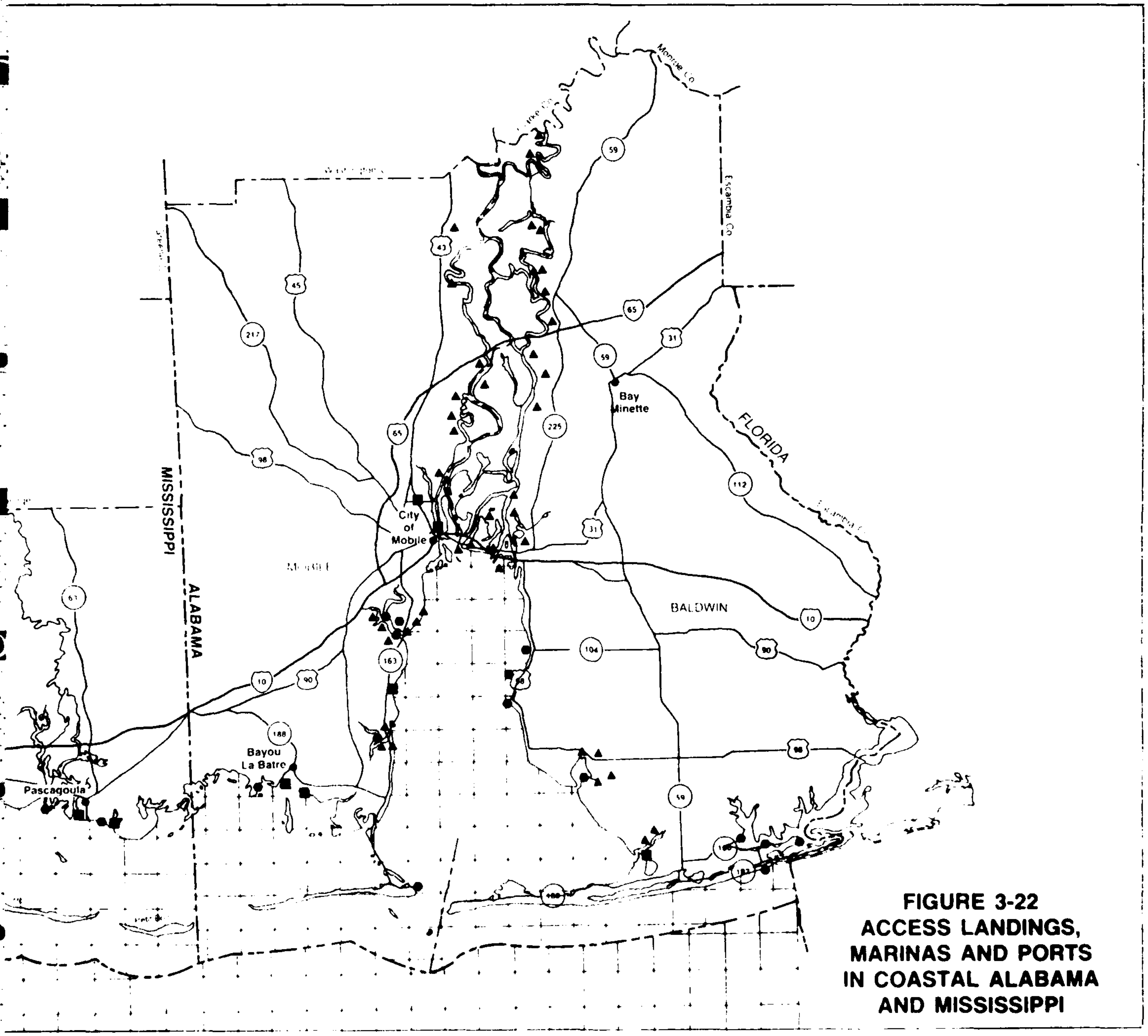


FIGURE 3-22
ACCESS LANDINGS, MARINAS AND PORTS IN COASTAL ALABAMA AND MISSISSIPPI

2

CHAPTER 4

ENVIRONMENTAL CONSEQUENCES OF UNIT ACTIONS IN THE MOBILE DELTA

INTRODUCTION

4.1 Potential environmental loadings and generic effects associated with hydrocarbon exploration and production unit actions in the Mobile Delta are discussed in this chapter. A unit action is defined as a group of activities or sequence of events that occur together to complete a particular portion of a phase of hydrocarbon exploration and production. Some examples of unit actions are site preparation for a drilling alternative, well completion, gathering system construction, and gas treatment facility operation.

4.2 The unit action analyses are presented according to the four major phases of activities that take place. Reasonable alternatives available for carrying out the necessary activities within each phase have been considered (see Appendix A).

- Geophysical Exploration Phase
    - Swamp buggies
    - Surveys from uplands
- Drilling Phase
    - Inland drilling barge
        - Canal and slip
        - River bank slip
        - River channel location
    - Fixed drilling platform
        - Canal access
        - Trestle road access
        - River bank location
    - Board road and ring levee
- Production Phase
    - Well completion
    - Gathering system construction
        - Wetlands
        - River crossings
    - Normal operations of wells and pipelines
    - Well workover
    - Enhanced recovery
- Abandonment Phase
    - Well sites
    - Pipelines

Spills of toxic or hazardous materials and the accidental release to the atmosphere of natural gas containing hydrogen sulfide are also considered for the drilling and production phases. Although land subsidence has occurred at various locations around the world due to production from oil and gas fields (Holzer and Bluntzer, 1984), it has not been a factor in the areas under consideration in this study nor would it be expected to be a factor for production from the deep formations under consideration (Mink, 1984b). Reduction of underground pressures has in some instances resulted in surface subsidence. In this region, no subsidence would be expected because of the depth of occurrence, stratigraphy, and rock strength or competence of the Smackover-Norphlet reservoirs. Rock units from 5,000 feet to as much as 21-22,000 feet consist of consolidated, competent limestone, shales, and sandstones. Fluid or gas withdrawal would not result in subsidence, since the reservoir fabric and the overburden are not supported by liquids or gas (U.S. Army Corps of Engineers, 1980).

4.3 Only those activities that would occur within the boundaries of the Delta are discussed in this chapter. Associated activities such as construction and operation of treatment facilities that would take place on adjacent upland areas are discussed in Chapter 7. A summary of loadings and generic effects is given in tabular form in Chapter 2.

Approach to Analysis

4.4 Environmental loadings resulting from exploration and production activities have been determined for each unit action, and the generic environmental consequences of each activity are discussed. For example, the quantity of wetland area affected by a canal and slip used for drilling at a location has been calculated and the generic effects of the loss of Delta wetland area discussed. However, the significance of these effects on the Delta region would be a function of the total amount of wetland area altered by many canals and slips in place at any time. This analysis is presented in Chapter 8 (Environmental Consequences of Regional Resource Development Scenarios). The unit action analyses of Chapter 4 serve as a basis for the cumulative effects determined in Chapter 8.

Organization of Chapter

4.5 The discussion of environmental loadings and generic effects in the Mobile Delta has been organized around the four major activity phases of geophysical exploration, drilling, production and abandonment, which constitute the major sections of the chapter. The details on loadings and generic effects associated with activities for each major phase are presented. These analyses are divided into site preparation, routine operations and accidents.

GEOPHYSICAL EXPLORATION

4.6 Geophysical exploration techniques are used to obtain information on the subsurface geologic structure of an area in order to identify potential hydrocarbon traps and to identify the best surface location for exploratory drilling and subsequent development drilling. Seismic exploration involves the use of an energy source, such as explosives, to produce vibrations that are transmitted through and reflected by the various rock layers and then detected and recorded for analysis. The type and velocity of the recorded vibrations indicate the general characteristics of the section of earth through which the vibrations pass.

4.7 For the Mobile Delta, and the rest of the environmental impact statement study area, broad scale regional seismic surveys have been made by various geophysical survey companies. Using such information, a petroleum exploration company would acquire leases and contract for detailed seismic surveys to identify the specific fine-scale structure within their lease holdings. Due to the wetland conditions of the Delta, seismic survey crews would use tracked vehicles (swamp buggies) and narrow, shallow draft pull boats in running their survey lines. Explosives placed in shallow holes (50 to 200 feet deep) would be used as a seismic energy source. Typically, a line of vibration detectors (geophones) connected to recording instruments is placed along a surveyed line, the shot hole is drilled, explosives are detonated in the shot hole and the resulting signals are recorded. This set of activities is repeated along a set of parallel lines and a set of shot lines at right angles to these lines until the area of interest has been covered. The length of a particular seismic line and the lateral spacing between seismic lines depends on the suspected size, type and configuration of the structure or structures being examined.

Swamp Buggies

4.8 In order to traverse the wetland terrain of the Delta, a swamp buggy is used. The swamp buggy used in the Delta is generally a narrow vehicle on tracks with a shot hole drill mounted at the rear of the vehicle. Deck space on the buggy is used for such items as explosives, drilling mud, drill string, and a two-compartment slush pit that allows for separating the cuttings from the drilling fluid. In the Delta, the shot hole is generally drilled to 50 to 200 feet. The seismic data are detected by groups of geophones connected to a cable leading to the recording instruments. Each group consists of several geophones spaced over several feet in a pattern designed to reduce the type of noise (i.e., unwanted signals) in a particular area. The complex geology of the Delta would generally require 96 groups (i.e., 96 signal channels) spaced

along a 2 mile cable. In shallow open water areas of the Delta, narrow, shallow draft pull boats may be used to continue stringing the seismic cable.

Hydrology

4.9 Surface water quality and hydrology impacts due to geophysical exploration are the result of loss of vegetation and creation of ruts. Multiple traverses of swamp buggies may destroy vegetation and create ruts (Longley et al., 1981). The loss of vegetation and creation of ruts makes a path for increased rate of flow of runoff and increased rate of inundation. The orientation and depth of the depressions determine whether they remain for long periods of time or alter the water regions of a given area (Longley et al., 1981). In areas inundated nearly continuously, depressions are less likely to alter water movement.

Water Quality

4.10 Increased erosion due to swamp buggy activities in the delta could add quantities of sediment to the downstream river channel. No method is available to estimate quantities of sediments to be resuspended; such quantities would vary depending upon the ruts created by the buggies, proximity of buggy operations to a river channel, and rainfall characteristics during and following buggy operations.

Wastewater Disposal

4.11 Sanitary wastewater volumes would be less than 10 gallons per day per person. These wastewaters would be generated only for very short time periods while the exploration takes place. Wastewaters would be discharged within the delta as practicable.

Wetland Area Disturbed

4.12 The swamp buggy is only 8 to 9 feet wide and would only disturb about 1 acre per mile for each survey line. It would push through brush and small saplings and maneuver around larger trees. In general, no trees or brush are cut to clear a right-of-way for a survey. Some reduction of primary production would temporarily occur in the disturbed area.

Drilling Fluids

4.13 The drilling muds or additives used in shot hole drilling are typically simple bentonite or montmorillonite compounds that are added to water to increase its viscosity enough to

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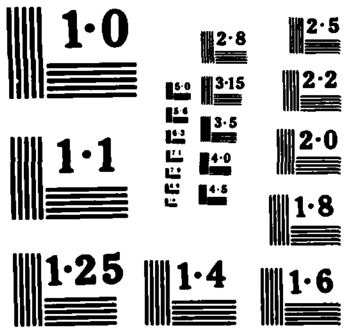
1·0
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lubricate the drill bit and to carry cuttings out of the drill hole. The amount of additive used is generally on the order of 1 part of additive per 200 parts of water.

Groundwater

4.14 Impacts to groundwater are minimal, resulting primarily from shothole drilling and possible pollutant infiltration due to leakage of fuel and lubricants from land- and water-based vehicles. Shothole borings are typically 50 to 200 feet deep, about four inches in diameter, made with rotary drilling methods using drilling muds or by air drilling and setting casing. These borings may penetrate the coastal-alluvial aquifer and at some points even the deeper Miocene aquifer. Potential for the introduction of pollutants through these borings exists.

Air Emissions

4.15 The scheme and scope of the unit action assessment utilized for air quality in the Mobile River Delta is presented in Table 4-1. There are essentially three phases of unit action; these are geophysical exploration, site preparation and exploratory drilling, and production.

4.16 Table 4-2 illustrates typical levels for air quality emission producers. A mix of representative vehicular emissions was selected for typical vehicles. This mix was used for assessing the impact of the vehicle selected. In reviewing U.S. Environmental Protection Agency (1978) emission data it was possible, with little compromise, to prescribe typical emissions per vehicle per day. In order to do so, assumptions had to be made concerning assigned travel per day per vehicle. 120 km/day/vehicle was assumed and it was estimated that four vehicles per exploration effort would be required. Activity levels were based on the number of vehicles required to do the work. All explorations were assumed to take 180 days. All explorations were characterized by this single type regardless of where the site was in the Mobile River Delta.

Solid and Hazardous Waste

4.17 The total volume of spoil from a 100-ft. deep, four-inch diameter shothole is less than ten cubic feet. Drilling mud is of limited quantity (shothole volume plus a reserve for circulation, approximately 100 to 150 gallons per hole). After shooting, as much casing as possible is recovered and the shotholes are refilled.

TABLE 4-1

SCHEMATIC OF METHOD FOR ANALYZING POTENTIAL VEHICULAR EMISSIONS IN THE MOBILE DELTA

Resource Extraction Phase	Activity Level Factor	Activity Duration (Days)
DRILLING		
Canal and Slip	5	180
Inland Barge	4	180
Drilling Platform	3	180
River Bank	3	180
Trestle Road	2	180
Upland Site	7	180
PRODUCTION[a]		
Well Completion	2	30
Gathering System	2	100
Normal Operations	5	300
Well Workover	1	60
Enhanced Recovery	3	90
Abandonment	1	30

[a]Assumes no vapor or oil storage - pipeline to onshore facility.

TABLE 4-2

TYPICAL VEHICLE EMISSIONS ASSOCIATED WITH HYDROCARBON DEVELOPMENT ACTIVITIES IN THE MOBILE DELTA

Vehicle Type	Units for Emission Measurement	Emission (Tons Per Year) Carbon Monoxide (CO)	Hydro-carbons (HC)	Nitrogen Dioxide (NOX)	Sulfur Dioxide (SO2)	Total Suspended Particulates (TSP)
Bulldozer	grams/hour	335	106	2290	158	75.8
Light Boat	grams/hour	1.69	.117	.179	.008	—
Light Truck (gasoline)	grams/mile	43.8	3.48	5.38	.188	.548
Heavy Truck (diesel)	grams/mile	30	5	21	3	1.3
Average Vehicle[a] Activity Level (4)[b]	grams/day	15.24[c]	252[c]	108[c]	180[c]	90[c]

[a]Assumed travel 75 miles per day.

[b]Activity Level - (1) one of each vehicle type or equivalent
(2) two of each type or equivalent, etc.

[c]For emission factors above and an activity level of 4 - the numbers for the average vehicle are multiplied by four. They are then corrected by multiplying by 180 days to determine the total tons per year (TPY) of pollutant for this activity. The calculation is shown here for this case to provide detail.

TSP 90 x 4 = 360 g/day x 180 days/yr x lbs/454g x tons/2000# = 0.07
SO2 180 x 4 = 720 g/day x 180 days/yr x lbs/454g x tons/2000# = 0.14
CO 1524 x 4 = 6096 g/day x 180 days/yr x lbs/454g x tons/2000# = 1.21
THC 252 x 4 = 1008 g/day x 180 days/yr x lbs/454g x tons/2000# = 0.20
NOX 108 x 4 = 432 g/day x 180 days/yr x lbs/454g x tons/2000# = 0.10

Socioeconomic Characteristics

4.18 Between 26 and 32 people would comprise a typical geophysical survey team in the Delta (Fowler, 1983, personal communication). Unskilled labor could represent about half of the crew. In 1983 nationwide, helpers to surveyors in extractive occupations earned about $245 per week (U.S. Department of Labor, 1983). Between 5 and 7 technical surveyors would be used in addition to 9 individuals operating 3 shot hole rigs. On the average in 1983 surveyors nationwide earned about $350 per week while surveying technicians earned about $330 per week (U.S. Department of Labor, 1983). The skilled technical and supervisory personnel would likely commute to the site on a weekly basis from their base of operations (Fowler, 1983, personal communication). They would stay in a nearby motel for the duration of the task. Equipment and personnel would be moved in and out of the vicinity by truck, car and van.

4.19 Laborers could be hired from the local labor pool. Local retail businesses are used extensively. Purchases of gas and food constitute the bulk of local purchases although minor equipment repairs could also be accommodated (Fowler, 1983. Personal communication). Once a survey is terminated the skilled technicans and equipment go to the next assignment, while local laborers seek other employment.

Surveys from Upland

4.20 Although it is possible to obtain some level of data for a portion of the Delta by having the seismic energy source on an adjacent upland, this is not a practical way of getting high quality data covering a normal area of interest. Additional discussion of this activity is included in Chapter 7.

DRILLING

4.21 After a geological formation that could potentially contain hydrocarbons is identified by geophysical exploration, a well must be drilled to determine if hydrocarbons occur there. If commercially recoverable quantities are found, additional wells are usually drilled to recover the maximum quantity of the resource in the most efficient and cost-effective manner consistent with the regulations of the Alabama and Mississippi Oil and Gas Boards. In general, a surface drilling location directly over the geological target (vertical hole) is preferred whenever possible for the initial well (wildcat well) because subsurface geological conditions that can affect drilling are unknown. Subsequent drilling may include directionally drilled wells (slant drilling) to reach subsurface locations lateral to the surface drilling site.

4.22 Three drilling methods are possible to various extents in the Mobile Delta:

- o Inland drilling barge.
- o Fixed platform with modular drilling rig.
- o Board road and ring levee with land drilling rig.

Drilling by the first two alternatives could be accomplished with varying amounts of wetland area disturbance by utilizing combinations of directional drilling and various methods of site access. The board road and ring levee alternative could only be used along the very edges of the Delta adjacent to the uplands. In the past, inland drilling barges have been used in the Delta with a canal and slip constructed through the wetlands to gain access to the drilling location.

4.23 In this section, alternative drilling methods selected for analysis are those that reduce the amount of wetland area altered as compared to the canal and slip method. Alternatives considered are the following:

- o Canal and slip for inland drilling barge.
- o River bank location for inland drilling barge.
- o Inland drilling barge in river channel.
- o Fixed drilling platform with canal access.
- o Fixed drilling platform with trestle road access.
- o Fixed drilling platform on the river bank.
- o Board road and ring levee.

4.24 Service bases and directional drilling from an upland location are discussed in Chapter 7.

4.25 Alterations to the Delta environment during drilling could result from drilling site preparation and construction, routine operation at the site, and from accidental spills of materials and loss of well control. The discussion below considers each of these.

Canal and Slip for Inland Drilling Barge

4.26 A standard inland drilling barge could be used for drilling in the Delta. Access to the surface location of drilling would be gained by dredging a canal from the nearest navigable channel to the well site. A larger area (slip) would be dredged at

the well site at the end of the canal to provide space for mooring and maneuvering vessels required to supply and service the drilling barge (Figure 4-1). The material dredged from the canal and slip area would be mounded on the wetland surface beside the dredged areas with 50 foot wide gaps left in mounds at intervals. Personnel and supplies would be brought to the location by boat and barge and, occasionally, helicopter and seaplane. Additional description of this drilling alternative is given in Appendix A.

Site Preparation

4.27 Preparation of the site would require clearing of trees from the area (except in the southern Delta), dredging of the canal and slip, preparation of a foundation for the drilling barge to rest on, and construction of the keyway at the well site.

4.28 Hydrology. Limited exchange of water would occur between a dredged, dead-end canal and the river channel assuming waters from the canal and river channel move perpendicular to each other. The river channel current would form eddies of circulation only near the mouth of the canal. Water movement within a dead-end canal would be very sluggish with water velocities probably not exceeding 0.1 feet per second (3 centimeters per second).

4.29 If waters from the canal and river channel are not perpendicular (e.g., a canal at the outer bend of a river) or if the canal is not a dead-end canal, circulation would be greater than for the typical case described in the previous paragraph.

4.30 Water Quality. Dredging for a canal and slip would increase turbidity with a corresponding decrease in light penetration which could decrease productivity in waters adjacent to the area being dredged. Barnard (1978) concluded that the "maximum concentration of suspended solids in the surface plume in the immediate vicinity of a typical clamshell or bucket dredging operation should be less than 500 mg/l and decrease rapidly with distance from the operation due to settling and dilution." The plume may extend for 300 meters at the surface and 500 meters near the bottom. Those sediments reaching the river from a canal should be diluted and dispersed relatively quickly. Barnard (1978) reports that the surface plume will probably dissipate rapidly, within an hour or two after the operation ceases. The heavy sediments forming the bottom plume in the canal should not travel as far due to the shallowness and quiescence of the canal waters.

4.31 Nutrients, trace metals, and oxygen-demanding substances that are adsorbed to or mixed in with sediment particles may also be released to the water column during dredging. Dissolved oxygen sags and productivity increases (from increased nutrients) or decreases

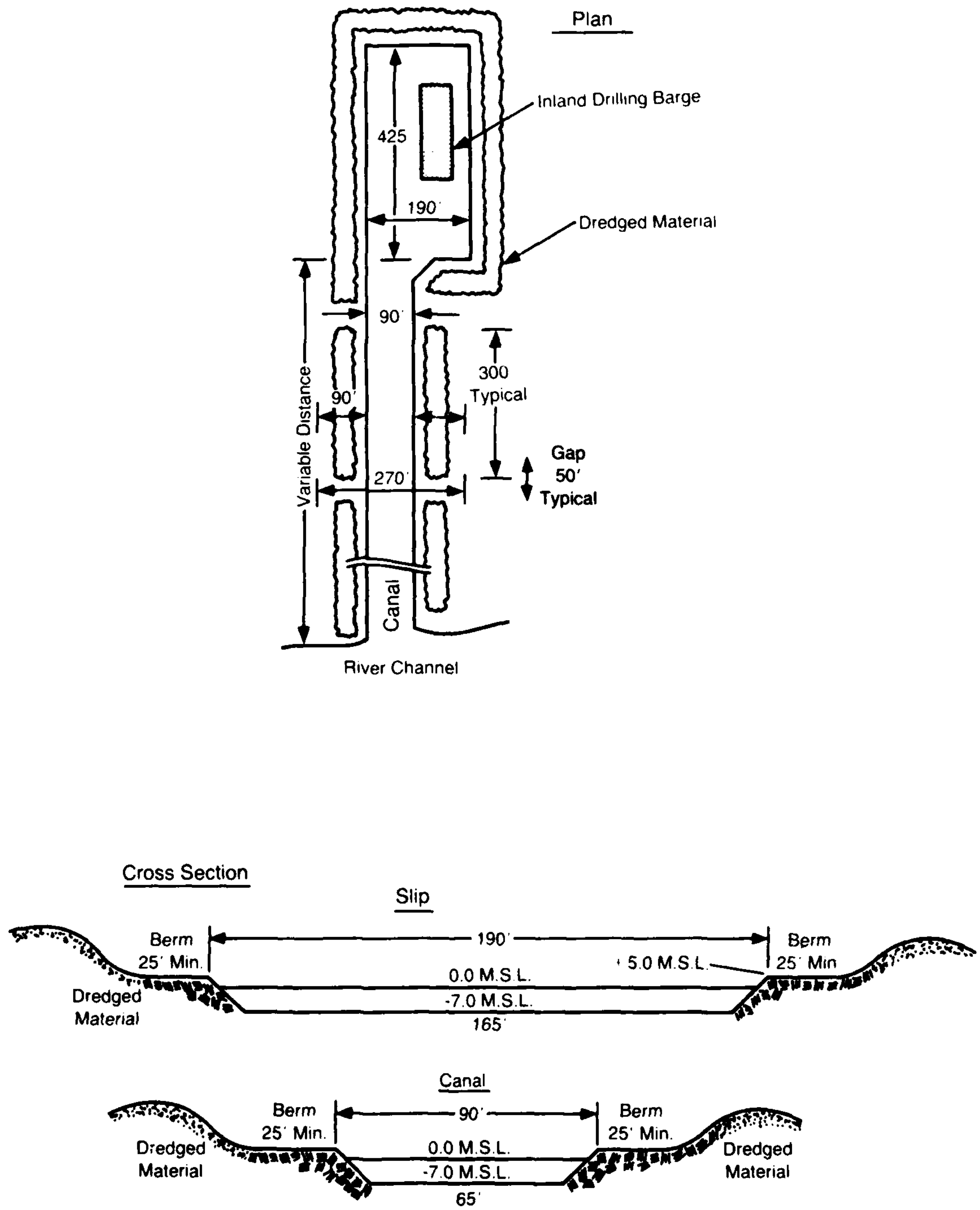

FIGURE 4-1
TYPICAL SITE PLAN FOR USE OF AN INLAND DRILLING BARGE IN THE MOBILE DELTA

(from reduced light penetration) may then follow. Three factors related to dredging have substantial effects on dissolved oxygen fluctuations (U.S. Army Corps of Engineers, 1979b); these are "the mass of sediments that becomes suspended, the chemical composition, especially of adsorbed materials of the sediment, and the amount of mechanical mixing of the water column and water surface. The chemical composition (concentration of oxygen-consuming chemicals and oxidation-reduction potential of sediments) and the suspended solids concentration determine the oxygen demand. Mechanical perturbation enhances the oxygen supply." Dredging wetland soils with a high organic content is likely to cause large local oxygen demands, but specific data are not available to quantify expected reductions in dissolved oxygen concentrations. Dissolved oxygen reductions would last for the duration of the dredging operation. Nutrients and trace metals are also likely to be released from the dredged sediments but data on actual concentrations have not been found. Shell pad placement, pile driving, and drill barge sinking would stir up bottom sediments in the slip. Relatively small amounts of sediments would be resuspended due to pad placement pile driving and barge sinking and these should settle quickly due to the shallow, quiescent nature of the slip waters.

4.32 Boat traffic associated with these activities would also stir up bottom sediments and add engine exhaust and allowable boat discharges to the water. Boat induced sediment resuspension would occur only in the canal and slip because the river channels are too deep (20 to 40 feet) to be affected. Again relatively small amounts of sediments would be resuspended and they would settle quickly. Creosote residues were observed at a well site in Mobile Bay as the result of timber cluster emplacement. A surface sheen surrounding the piles was observed for a period of five days, and oil and grease residues of 0.06 to 0.44 mg/l were measured (TechCon, Inc., 1980). No data were found to quantify the impact on water quality due to engine exhaust. However, the impact should be minor due to the small number of boat trips made during site preparation.

4.33 For a canal and slip and for all of the site access methods, some wetland area would be lost, at least until the site is properly abandoned and allowed to slowly restore to natural conditions. Any loss of wetlands results in long-term reductions in the ability of a wetland to maintain quality of the water passing through the wetlands. Within wetlands, solids are deposited and other water constituents such as nutrients are assimilated by soil particles and vegetation. Wetlands in their natural condition are effective sinks for solids and soluble compounds transported from upstream areas. Loss of wetlands in the Delta due to dredging for any form of drilling site access would result in some loss of the ability of Delta wetlands as a whole to maintain the quality of waters released by the wetlands to the river channel and subsequently to Mobile Bay.

4.34 Wetland Ecosystems. Wetland areas would be altered in varying degrees through the dredging of an access canal and barge slip and through placement of dredged material on wetlands adjacent to the canal and slip. For a typical barge slip, at the end of the canal approximately 5 acres would be altered. Half of this area would be altered through the dredging itself, creating about 2 1/2 acres of open water. The remaining 2 1/2 acres would include the 25 foot berm surrounding the slip and the stockpiled dredged material immediately beyond the berm.

4.35 For a typical access canal, dredged material is stockpiled on either side of the canal, usually with gaps every 200 to 300 feet to allow natural flow of water. For each 1000 feet of canal approximately 5 to 6 acres of wetland area would be altered. Of this total area disturbed, about 1/3 would be dredged and the remaining 2/3 would be the area for the stockpiled dredged material and for the berm. The construction of a typical 2000 foot canal with slip for an inland drilling barge would alter about 15 to 17 acres of wetlands. Effects on wildlife resources are discussed in the section on routine operations.

4.36 Aquatic Ecosystems. Dredging of the canal and slip system could alter aquatic systems in two ways:

- Direct destruction of benthic communities and habitat.
- Turbidity from the dredging operation which could affect benthic and water column organisms.

Direct destruction of benthic habitat by dredging is likely to occur only in the vicinity of the canal entrance in most of the Delta because the depths of most natural channels are sufficient to allow passage of a drilling barge to any canal site. In the shallow southern Delta extensive dredging could be required.

4.37 About 3 to 4 acres of benthic habitat would be affected per 1000 feet of dredged access channel length. This assumes that the channel and dredged material deposition area adjacent to the channel are of equal width. The amount of benthic area that might be dredged for an access channel at the mouth of a canal would probably be on the order of several tens to 100 feet long by 65-75 feet wide in most of the Delta. In the extreme southern portion of the Delta near the Battleship Parkway, channels several hundred feet long by 65-75 feet wide may be required in the shallow bays.

4.38 Aquatic organisms downstream of the channel could also be affected by turbidity resulting from the dredging operation. This effect may be lessened by the fact that many organisms in a riverine Delta environment are already adapted to periods of naturally high turbidity.

4.39 The potential effects of increased concentrations of suspended solids include clogging gills and feeding apparatus, reducing light penetration and limiting primary production, reducing dissolved oxygen concentrations because of increased biochemical oxygen demand of the resuspended solids, and burial by redeposition of suspended material (Stern and Stickle, 1979). Motile organisms, such as fish, would probably avoid the area of greatest turbidity. However, planktonic and drift benthic organisms may be adversely affected within the plume. Fish eggs and larvae could be smothered by redeposited sediments.

4.40 Deposition of material resuspended by dredging would be greatest immediately downstream of the canal mouth, decreasing downstream. The area receiving significant quantities of deposition is likely to be small. Some species of benthic organisms move freely through the sediment and could extricate themselves after burial under even several inches of sediment. Other benthic species reside in permanent or semipermanent burrows or tubes and would be less likely to survive burial. Measurements have not been made in the Delta but recovery could be within 2 years (see routine operations).

4.41 Groundwater. Within the Delta, significant impacts from site preparation activities are typically at or above the ground surface generally impacting little on groundwater. However, such effects as altered drainage could possibly cause localized alterations to groundwater quality in the uppermost portions of the alluvial aquifer by infiltration of nutrient contaminant laden runoff in the disturbed area. Additionally, dredging could produce localized changes to flow gradients and possibly allow saline intrusion in the groundwater. Most effects, if any would be expected to be minimal and very localized.

4.42 Air Emissions. Table 4-3 illustrates the different alternative ways of drilling with the ancillary vehicular emissions expected. The upland drilling rig type was regarded as the greatest potential source of emissions and the trestle road location produced the least emissions.

4.43 Noise. Noise is produced from several sources under various unit action alternatives in the Mobile River Delta, Mobile Bay and Mississippi Sound, the Gulf of Mexico, and upland areas.

TABLE 4-3

EMISSIONS GENERATED BY VEHICLE, RIG AND GAS PLANT OPERATIONS DURING HYDROCARBON RESOURCE DEVELOPMENT IN THE MOBILE DELTA

Resource Extraction Correction Phase	Activity Level Factor	Emission (Tons Per Year) Carbon Monoxide[d] (CO)	Hydro-carbons (HC)	Nitrogen Dioxide (NOX)	Sulfur Dioxide (SO2)	Total Suspended Particulates (TSP)	Factor
GEOPHYSICAL EXPLORATION[a]		1.210	0.200	0.100	0.140	0.070	--
DRILLING[a]							
Canal and Slip	5	1.450	0.240	0.120	0.168	0.084	--
Inland Barge	4	1.210	0.200	0.100	0.140	0.070	--
Drilling Platform	3	0.910	0.150	0.075	0.105	0.052	--
River Bank	3	0.910	0.150	0.075	0.105	0.052	--
Trestle Road	2	0.605	0.100	0.050	0.070	0.035	--
Upland Site	7	2.120	0.350	0.175	0.245	0.122	--
PRODUCTION[a]							
Well Completion	2	0.101	0.017	0.008	0.011	0.006	30/180
Gathering Systems	2	0.336	0.056	0.028	0.039	0.019	100/180
Normal Operations	5	2.420	0.400	0.200	0.280	0.146	300/180
Well Workover	1	0.101	0.107	0.008	0.012	0.006	60/180
Enhanced Recovery	3	0.458	0.075	0.038	0.052	0.026	90/180
Abandonment	1	0.050	0.008	0.004	0.006	0.003	30/180
RIG OPERATION[b]		162.000	2.800	390.000	26.000	13.400	--
GAS PLANT AND SULFUR DEPOT[c]		7.000	4.000	74.000	220.000	2.000	--

[a]Emissions tabulated are those generated by vehicles only.

[b]All phases of rig operations were considered in assessing these emissions. In short, emissions from the rig during activities such as well completion and well workover are included here and are not included in the columns covering vehicle emissions. (Mobile Oil Exploration and Producing Southeast, Inc. (MOEPSI) 1981a).

[c]A more precise method of determining these emissions would have been to cite specific emissions for specific activities, for specific vehicles, for specific durations in specific areas. In aggregate, the emissions as stated, are conservatively high estimates of air quality impacts (U.S. Army Corps of Engineers, 1982a).

[d]Calculated for four (4) rigs.

Numerous construction equipment and manufacturing processes have been identified in this generic review, with noise emittance levels. Many sources listed in Appendix E were excerpted, synthesized, or otherwise derived from Bolt, Beranek, and Newman, Inc., (1971), the U.S. Environmental Protection Agency, Region IV (1978), Berkau et al. (1975), and the New England River Basins Commission (1976). Additional examples are provided within the text. Because many of the noise sources apply for several of the alternatives and geographic areas, there is some overlap of noise sources and impacts.

4.44 Preparation of a canal and slip for an inland drilling barge and support barges would involve dredging and, if necessary, clearing activities. Land clearing (mean=75 dBA: Appendix E) may require conventional construction equipment comparable to front loaders and dozers or specialized wetland/marsh all-terrain equipment, presumably having comparable or perhaps slightly higher noise level productions than the conventional equipment. Chain saws may also be needed (average dBA at 50 ft=83: Berkau et al., 1975; 100 dBA, presumably at operator's position: New England River Basin Commission, 1976). Dredging noise would probably involve emissions from a dragline and bucket dredge (mechanical) operation assisted by a tug boat. Levels would therefore probably be above 85 dBA at 100 feet, which was the expected level listed by the U.S. Environmental Protection Agency, Region IV (1978) in their draft Environmental Impact Statement concerning the Ideal Basic Industries for the proposed dredging of the Theodore Ship Channel in Mobile, Alabama using a hydraulic dredge (27 inch), pump, and tug boat. Noise levels would also likely fluctuate intermittently for mechanical dredging as compared to a more continuous hydraulic dredging operation.

4.45 Once the site is prepared, the inland drilling barge would be towed on site with tug boats. A large tug with four loaded barges, for example, emits an L_{50} of 55 dBA at 100 feet (U.S. Environmental Protection Agency, Region IV, 1978). A large tug pushing a barge near a dock area, which might be similar to positioning a drilling barge once on location, produces an L90 of 58 dBA at 100 feet. Several tugs would probably be necessary for towing and maneuvering.

4.46 After the drilling barge is in position and flooded to rest on the bottom, the barge would be anchored with pilings. Setting pilings would produce loud intermittent noise levels. Pile drivers produce 101 dBA at 50 feet.

4.47 Solid and Hazardous Wastes. The primary solid waste produced by this alternative is dredge material and biomass from land clearing activities. However, since these solid waste materials remain on site for future reclamation efforts, they are not considered as a solid waste disposal issue for this study. Potentially hazardous waste, in the form of fuels and lubricants, are utilized during this phase of hydrocarbon development. The small quantities on site at any one time exclude them from RCRA regulations and pose little hazard to environment due to accidental spills. Nominal amounts of domestic wastes (mostly trash) are also generated by the site preparation crews.

4.48 Socioeconomic Characteristics. There are three stages involved in constructing a canal and slip for an inland barge:

- Clearing the area to be dredged.
- Dredging the canal and slip and preparing the foundation.
- Building the keyway structure.

Depending on the stage of activities and contracting circumstances the labor may be local or out of state. Activities associated with each stage and corresponding labor requirements are described in the following paragraphs.

4.49 The first stage is clearing the land to be dredged. About 6 laborers and a foreman are needed. Nationwide in 1983 construction laborers earned an average of about $270 per week while supervisors collected about $100 more per week (U.S. Department of Labor, 1983). Clearing crews can, and have been, local or out-of-state residents. A canal and slip excavated in early 1983 used a Louisiana crew because time restrictions prohibited arranging for a local workforce (Stockstill, 1983. Personal communication). In other cases the clearing crews have been subcontracted through Mobile-area firms (Bergeron, 1983; Stockstill, 1983). The site is cleared using chain saws. Stumps are left to be removed with the dredged material. A crew of six can usually clear between 1 and 2 acres per day (Stockstill, 1983; Bergeron, 1983). In the event the crew is local, local employment is stimulated. If it is not local, and the job requires more than a day, the workers reside in a nearby motel (Stockstill, 1983). A crew boat would provide transportation to and from the site from a nearby landing.

4.50 Dredging and foundation preparation occurs once the site is cleared. A self-contained dredging barge and crew is tugged in by a contracted tug. A typical crew is composed of between 8 and 10 people (Carstea, et al., 1976; Stockstill, 1983; Bergeron, 1983):

- o 1 captain
- o 2 operators
- o 2 oilers
- o 2 deckhands (1 for each shift)
- o 1 extra hand
- o 1 cook

According to the U.S. Department of Labor (1983) individuals in water transportation occupations, including captains, mates and deck hands, not involved in fishing, earned an average of about $460 per week in 1983. The crews live on the barge, operating on a 14-day-on, 7-day-off tour, working in twelve-hour shifts (Stockstill, 1983). In two previous Delta dredging operations the barge and crew originated from Louisiana (Stockstill, 1983; Bergeron, 1983). Local dredging firms also have the larger equipment required to complete the jobs in a time- and cost-efficient manner (Workman, 1983).

4.51 About 3 days would be required to dredge a slip and build a foundation (described in Appendix A). Another 3 days would be needed for each 1000 feet of canal, barring inclement weather or difficult soils. If a crew change were necessary the replacements would either be responsible for their own transportation to the landing, or it could be provided for them from the company's home base. This arrangement varies among dredging contractors (Bergeron, 1983; Stockstill, 1983).

4.52 Keyway construction is the final stage in site preparation. A new crew of pile drivers is brought in. Typically, the crew includes between 4 and 8 people (Stockstill, 1983; Bergeron, 1983). In the Delta, it is usually more cost effective to contract with a local firm. Several of the area's marine construction businesses have the capacity to perform this work, which is bidded out on a competitive basis (Stockstill, 1983). Pile driving is the least time-consuming stage of site preparation, generally requiring no more than one day.

4.53 Navigation. The site preparation phase would add to the local waterway traffic through the movements of a barge-mounted dredge and pile driver and the various supply boats, crew boats, and barges and tugs necessary to service the site activity. Additional waterway traffic could be generated by seaplanes for occasional transport of company personnel or by small boats used by federal, state, or company inspectors checking the operations. (The width of many of the waterways in the Delta makes seaplane transport an efficient mode of travel for company personnel on a tight time schedule).

4.54 Although the exact number of trips for many of the vessel types would depend on the location and nature of a specific site, a reasonable estimate can be made for waterway traffic due to site preparation. The barge-mounted dredge and the barge-mounted pile driver would each make one round trip from their port of origin. The port of origin could be in the Louisiana area for the dredge and the Mobile area for the pile driver. Generally, the tug bringing the barge would return after the dredge is on station and a second tug would be used to return the dredge at the completion of site preparation. During site clearing, the crew boat would make one round trip per day between the site and a local boat landing. During the remainder of site preparation, the crew boat would average one trip per week.

Routine Operation

4.55 Once the drilling barge is placed on location, drilling of the well is begun.

4.56 Water Quality. Impacts to surface water quality from normal activities during the routine operation of the drilling phase are an increase in turbidity due to erosion and increased turbidity and concentrations of engine exhaust products from boat traffic, and possibly lower dissolved oxygen concentrations in canal waters. Water flow in the canal and wave action due to boat traffic can erode the sides and bottom of the canal. Barren spoil banks are subject to erosion from wind and stormwater runoff. This impact is reduced when spoil banks revegetate. Spoil banks can revegetate to some degree naturally within two years based on observations in Texas and Louisiana delta areas (Longley et al., 1981). No quantitative data on erosion caused by dredging of a canal and slip or due to boat traffic has been found. Ensminger (1963: as cited in Longley et al., 1981) noted that dredged canals often widen, doubling in width in five years. However, Conner et al., 1976, stated that erosion plays only a minor part and can be controlled by using rip rap. Widening of canals due to erosion has not occurred at the site developed to date in the Mobile River Delta. However erosion can occur if soils are not cohesive, if vegetation is not established on the banks, if water velocities and hydrocarbon development activities encourage erosion (e.g. erosive boat wakes). Erosion is generally more of a concern in the salt marshes of the southern delta that in more upstream areas.

4.57 Because of the quiescence of the canal and slip, suspended sediments from erosion may settle in the canal and slip. Longley et al. (1981) stated that maintenance dredging of canals may occur every six months to five years, depending upon siltation rates. However, in two years, Superior Oil Company has not done any maintenance and does not expect to have to do any maintenance

dredging through the life of the well (Settoon, 1983). Whether maintenance dredging would be required at other canals within the Mobile River Delta would depend upon site characteristics (including soil type and water velocities) and also upon initial dredging operations and spoil bank construction.

4.58 Isolated dredged areas such as canals and slips with only one connection to a river channel can also act as sedimentation basins. Organic material trapped from the river or washed off the surrounding wetlands can accumulate on the canal bottom and support biological activity that consumes the dissolved oxygen in bottom waters. With little exchange between river and canal and limited circulation within the canal, little reaeration occurs and the dissolved oxygen concentrations can drop below 5 mg/l - the normal water quantity standard for dissolved oxygen.

4.59 The U.S. Environmental Protection Agency is currently preparing a report of dissolved oxygen measurements made within a number of freshwater, dead-end canals throughout the southeastern United States. Some preliminary conclusions from their work are as follows (Hicks, 1983):

- Canal depth is more significant than canal length or width in affecting dissolved oxygen levels in finger canals;
- Maximum canal depths of four to six feet are recommended to keep dissolved oxygen levels at or greater than four to five mg/l;
- Conclusions from the 1975 work in Florida (U.S. Environmental Protection Agency, 1975) for saline canal waters are also applicable to fresh water canals;
- If canals are necessary, they should preferably be located extending from circulating river waters rather than from pooled, more stagnant waters; and
- Impacts of canal:
  - Some marsh areas are eliminated for the duration of the dredging activities resulting in some loss of wetland ability to maintain water quality.

- Canals can become sinks/traps for organic matter from adjacent marsh;

- Dissolved oxygen levels can decline, particularly in bottom waters, which can result in increased nutrient and metal mobilization and also in reduced rates of decomposition. Migrating fingerlings or shellfish larvae could perish;

- Salinity levels increase in bottom waters if salinity can penetrate into the canal from coastal waters; and

- Suspended solids and turbidity levels increase due to dredging and also due to spoil bank erosion.

Two possible shortcomings about applying the studies of existing canals to canals which may be dredged in the Mobile Delta are variations in water depths in rivers connected to canals and the development of sills of sediment at the mouth of existing canals, thereby inhibiting water mixing between the river and canal.

4.60 Hydrology. The canal creates a route for inundation by adjacent waters and for drainage of surface water runoff. The spoil bank's pattern will determine whether the canal waters are isolated from the rest of the marsh. The spoil banks may interrupt flow both into and out of the canal. Flooding carries nutrients throughout the marsh and dilutes and removes wastes (Conner et al., 1976). Leaving gaps in and restricting the height of spoil banks would reduce the impedence of surface water flows. Maintaining continuous spoil banks, on the other hand, could help to isolate canal waters with potentially poor water quality from surrounding wetlands.

4.61 During prolonged periods of low freshwater flow, a salt wedge from Mobile Bay can move into the river channel. The canals would not affect the movement of the salt wedge up the river channel, but if the salt wedge extends close enough to the river surface and far enough upstream to "spill" over a canal sill (if present), the canal could carry the salt wedge deeper than normal into the Mobile River Delta.

4.62 Wetland Ecosystems. The wetland area within the canal, slip and material deposition area would be lost for the duration of the period of drilling. The period could last from several months for a single shallow well to several years if a number of deep wells were drilled at the location.

4.63 All wetland values would be lost from the area of the canal for the period the canal remained in place. In the southern treeless portion of the Delta, areas of emergent vegetation are important as sources or organic detritus to adjacent aquatic systems, as nursery and refuge areas for aquatic organisms and as important food sources for waterfowl. The bottomland hardwood forest habitat removed in the rest of the Delta would not be available as spawning and feeding habitat for fish nor as a source of organic leaf material for the detritivore food web or of acorns and nuts for deer and waterfowl during periods of inundation.

4.63a Revegetation of dredged material placed adjacent to the canal and slip would occur slowly. If the canal and slip were abandoned within 12 to 18 months, only some vegetation by shrubs and grasses would have occurred so that almost all wetland areas would be lost from the area for this short period. If the canal and slip remain open for a longer period, revegetation by wetland species would continue. A discussion of vegetation succession on dredged material piles in the Delta is given in the Production section at paragraph 4.400a.

4.64 It is possible that some local alteration to the vegetation community in the vicinity of the canal could result from localized changes in groundwater hydrology from the presence of the canal and from the presence of more saline water if intrusion of the salt wedge into the canal occurs. It is difficult to state how extensive an area, if any, could potentially be altered, but it is likely that the effect would be localized.

4.65 Aquatic Ecosystems. Aquatic ecosystems near the mouth of the canal would be affected by temporary turbidity created by propwash from service vessels entering and leaving the canal. In general, this turbidity would be of short duration. In the bottomland hardwood areas of the Delta, the adaptation of aquatic organisms to naturally occurring periods of high turbidity should result in a very small effect, if any, over a very limited area.

4.66 In the shallow bays of the southern portion of the Delta, temporary turbidity could have some effect on submersed aquatic vegetation near the canal by limiting light penetration or by continual sedimentation. The area affected would be difficult to predict but is likely to be small.

4.67 Because of the 7 or 8 foot depth, it is unlikely that submersed aquatic vegetation would develop in the canal and slip in the shallow southern Delta. Vessel traffic in the canal would also affect the establishment and growth of vegetation. It is likely that the area of the canal and slip would be removed as habitat for

submersed aquatic vegetation for the period that the area remained unrestored to original contours, reducing the value of the canal area as waterfowl feeding habitat.

4.68 Colonization by benthic organisms of any dredged channels and adjacent dredged material disposal areas would begin immediately from settlement of larvae from the water, drift of organisms from upstream and migration of mobile organisms from adjacent areas. No studies of benthic recovery of dredged areas in the Delta have been carried out, but recovery is likely to be rapid (probably within 2 years).

4.69 Aquatic habitat of about 2 or 3 acres per 1000 feet of canal would be created by construction and operation of the canal and slip. No studies of existing abandoned and unrestored drilling canals in the Delta have been undertaken, but it is likely that the aquatic community that would develop in most of the Delta would be typical of adjacent channel areas. However, recolonization by benthic organisms could be slowed or prevented if low dissolved oxygen concentrations develop in the bottom waters of the canal (see water quality section). In the shallow bays of the southern Delta a community more typical of the deeper channels may develop because of the depth of the canal and slip compared to adjacent areas. Propwash of service vessels in the channels and canals could also slow the recolonization rate or affect the type of community that developed.

4.70 Fish feeding, spawning and nursery area would also be created in the canals. The value of this habitat may depend on the oxygen conditions in the canal, the benthic community that develops, and the effect of propwash of service vessels.

4.71 Wastewater Disposal. Wastewaters from any hydrocarbon drilling rig include sanitary wastewaters, runoff and other liquid wastes. Each inhabitant of a rig generates 30 to 40 gallons of sanitary wastewaters each day for crews that reside at the rig for 3 to 4 days at a time.

4.72 Some facilities for wastewater management at a well site such as wastewater treatment processes and storage lagoons may be located at well sites. Wastewaters can also be managed at off-site facilities such as municipal wastewater treatment plants and refineries. Based upon treatment technology requirements, effluent quality requirements, and the selected method of wastewater disposal at each treatment site, the wastewater can be pretreated entirely by itself or it can be pretreated and subsequently discharged to a local municipal wastewater treatment plant for further treatment. The compatibility of hydrocarbon wastewaters with other wastewaters should be analyzed before the two waste streams could be blended.

4.73 After the wastewater from a well site is transferred to an upland location, the treated hydrocarbon watewaters could conceivably be disposed to a local water body, to an evaporation-percolation pond, via an injection well or conceivably be applied to the land surface. A proposed disposal method would need to be approved by the appropriate state agencies prior to implementation.

4.74 The no discharge requirement can be met if produced waters are injected at or near the producing well sites, which often makes this method of disposal economical to hydrocarbon producers.

4.74a Discharges from marine vessels are allowed under U.S. Coast Guard regulations (33 CFR Part 159) and Section 312 of the Clean Water Act. Those vessels with installed toilet facilities must have marine sanitation devices that are properly tested, certified and installed (see 33 CFR Part 159) in order to properly treat wastewaters prior to discharge. Different requirements apply for Type I, Type II and Type III sanitation devices, with Type III not allowing on-site discharge. In addition no discharges from vessels shall have a visible oil sheen (greater than 15 milligrams per liter of oil and grease).

4.75 Groundwater. The potential impact to groundwater from the various drilling techniques and site access methods are generally similar, varying only with site specific geologic and hydrogeologic conditions.

4.76 During routine drilling operations in the Delta, interface with groundwater may occur primarily from direct contact with groundwater aquifers during the drilling of the well hole, or through infiltration of wastewater and stormwater runoff from the drilling site.

4.77 As the rotary drill passes through water-bearing formations, it exposes these formations to possible loss of artesian pressure from release of water into the bore hole and to possible contamination from fluids in other formations. The use of drilling fluid to lubricate the drill bit and to carry away cuttings helps prevent the loss of artesian pressure from the water-bearing formations. The hydrostatic pressure of the drilling fluid counters the artesian pressure of the water-bearing formation, normally preventing loss of fresh water from the aquifer. Bentonite or other additives are used in the drilling fluid to help seal porous strata and prevent the loss of the drilling fluid into the water-bearing formation. However, if a very porous or cavernous fresh water aquifer is penetrated during the drilling operation, large amounts of drilling fluid may enter the aquifer before sealing can be effected. Potential contamination of the fresh water supply could

be great for a localized area. Hazards associated with this contamination would depend upon the constituents of the mud in use at the time of loss (Collins, 1975).

4.78 Steel casing is set in place to maintain the structural integrity of the walls of the hole and cement is placed between the walls of the hole and the casing to seal off water-bearing formations. Well casing requirements in Alabama and Mississippi are provided in Chapter 3. In both states the minimum casing surface and first intermediate requirements are based on the proposed total vertical depth (TVD) of the well. For hydrocarbon wells with depths of 18,000 to 20,000 feet or more, the required surface casing would extend well below the base of the fresh water-bearing aquifer. While the well will always be cased from the surface to the producing zone, the requirement of surface and intermediate casing provided added protection to freshwater zones. For shallow wells the minimum specified casing may not extend below the water table aquifer. For example, a 5,500 foot well would only require a 600 foot and 440 foot surface casing in Alabama and Mississippi respectively, whereas the Miocene aquifer depth may range from 500 to 1,500 feet or greater. However, both states regulate separately that prior to production, all oil, gas and water strata above and below the producing horizon shall be sealed or separated to prevent interstrata flow, and therefore groundwater should be protected (Mississippi State Oil and Gas Board, n.d.; Alabama Oil and Gas Board, 1983).

4.79 Air Emissions. Air emissions from routine operations are shown in Table 4-3.

4.80 Noise. The principal noise source from routine operations of an inland drilling barge would be the diesel engines powering the primary movers. Bare engine exhaust and mechanical noise levels (at 23 feet) of various Caterpillar Tractor Company diesel engines generally related to the petroleum industry and used for marine propulsion, industrial, and generator purposes, are listed in Appendix E. It is assumed that drilling rigs (inland barges, platforms, jack-ups, submersibles) are basically similar in engine design for the four geographic areas of concern. Some differences can be present, however, such as the type of cooling system used (e.g., radiator fan noise in mechanical land rigs). Other differences can be due to engine model number, horsepower and rpm rating, installation enclosures, and mufflers, as well as model year and brand name. Some rigs are also mechanical while others are electric, with electricity supplied by diesel generators. Actual noise levels generated by maintained engines equipped with attenuating mufflers and enclosures would be less than bare engine readings presented in Appendix E.

4.81 Noise attenuation distances can differ considerably due to topography, vegetation, and atmospheric conditions. For the canal and slip inland drilling barge alternative, rig noise would be somewhat dampened in Delta areas of forested wetlands and hilly areas. Noise from drilling barges in marshes, typically flat areas with low level vegetation, would have a relatively long noise attenuation distance.

4.82 Noise from drilling activities is often continuous on a 24-hour basis and can be long term. For example, the proposed 19,000-foot well reviewed in the permit issued to Superior Oil Company by the U.S. Army Corps of Engineers, (1981c) for inland barge drilling in the Mobile River area was expected to require approximately 270 days. Because drilling can be long term and continuous, it becomes particularly important to any neighboring human and wildlife populations that may be found in the Delta area. Comparable open water drilling would have less impact since fewer animal (terrestrial) and human receptors are typically present offshore. However, noise does not attenuate as well in open water areas compared to vegetated forest land areas and therefore may reach onshore.

4.83 Noise produced by tug boats and associated barges that may be needed for supplies and/or waste removal should be similar to noise data are presented in Appendix E. Motorboats, which may be used as additional support vessels, produce an average of 80 dBA at 50 feet. Bare engine exhaust and mechanical noise levels for various Caterpillar Tractor diesel engines used in marine propulsion are available in Appendix E.

4.84 Solid and Hazardous Waste. Hydrocarbon exploration and development activities in the project area can generally be classified as producing substantial volumes of solid wastes which are normally neither hazardous nor toxic in nature. The type and volumes of wastes generated and waste disposal practices do not vary significantly within the different regions of the project area. Nearly all wastes produced from oil and gas activities in the project area are stored in disposal barges and transported to one of several local firms or firms located outside of the project area which are permitted to treat, reclaim, and/or dispose of these various waste constituents. Only for upland areas is there any significant variation in the waste disposal process since these mainland locations can store, treat, and even dispose of a portion of their wastes on-site. Regulations pertaining to solid waste disposal from offshore rigs are mentioned first in the sections below (details are contained in Chapter 3). Second, the potentially hazardous constituents of drilling muds and cuttings are identified. Finally, the estimated volumes of the principal wastes

generated from drilling operations by rig capacity and by well volume are discussed. These discussions apply to all drilling in the Delta, regardless of rig type or location.

4.85 In the Mobile River Delta, Mobile Bay, Mississippi Sound, and the Gulf of Mexico, no solid waste discharges are permitted to state waters in accordance with federal and state regulations. Under zero discharge regulations, drill rigs are built or are modified to collect all wastes and potential runoff and overboard discharges. Drill muds and cuttings are gathered through a closed system for disposal, generally by barge. Engines and drilling equipment are isolated by coamings and drains and routed to the same disposal barges. Deck area rainwater and spillage is also routed to the disposal barges. Water, mud, washwater, and other materials from the rotary and rig floors are collected and drained to the barge. All fill lines are located so that valves and couplings are over the deck where they can be drained to the barge in case of leaks (Oil and Gas Journal, 1983e). Sanitary wastes are generally provided secondary treatment and collected in the disposal barges. Rubbish and garbage are collected in the barges for transport to mainland disposal sites (U.S. Army Corps of Engineers, 1980). Generally, such disposal barges are compartmentalized to segregate the various waste types.

4.86 Drilling muds, cuttings and sanitary wastes are the principal materials generated during routine operations. Other than oils, the primary drill mud characteristics with potential effects are oxygen demanding pollutants, heavy metals, toxicants, and dissolved or suspended solids. Drill cuttings are composed of rock, fines, and liquids contained in the geologic formations that have been drilled through. The exact makeup of the cuttings varies from one drilling location to another, and no attempt has been made to qualitatively identify cuttings.

4.87 The two basic classes of drilling muds used today are water based muds and oil-based muds. Water based muds are formulated using naturally occurring clays such as bentonite and attapulgite and a variety of organic and inorganic additives to achieve the desired consistency, lubricity, or density. Fresh or salt water is the liquid phase for these muds. The additives are used for such functions as pH control, corrosion inhibition, lubrication, weighting, and emulsification.

4.88 Drilling constituents for onshore operations will parallel those for offshore, except for the water used in the typical mud formulation. Onshore drilling operations normally use a fresh water based mud, except where drilling operations encounter large salt domes. Then the mud system would be converted either to

a salt clay mud system with salt added to the water phase, or to an oil-based mud system. This change in the liquid phase is intended to prevent dissolving salt in the dome, enlarging the hole, and causing cavities in the formation. In either case, the drilling mud is transported to an approved disposal site and is not reclaimed or reused.

Oil-based muds contain carefully formulated mixtures of oxidized asphalt, organic acids, alkali, stabilizing agents and high-flash diesel oil. The oils are the principal ingredients and represent the liquid phase. Due to their relatively high cost, oil based muds are not commonly used. When they are used they are typically collected and processed for reuse.

4.89 Basic drilling additives used in the project area are presented in Tables 4-5 and 4-6. For the wells studied shown in Table 4-6, barite was the major component comprising 61 percent to 90 percent by weight of all additives (468 to 1,798 short tons/well). Clays (bentonite and attapulgite) ranged between 27 and 454 tons/well, and lignosulfonates ranged from 5 to 53 tons/well. Quantities of other components were highly variable, generally aggregating to less than 50 tons per well.

4.90 The hazards associated with the individual components that make up a drilling composition may be great (as experienced in a spill or accident) but the hazards of the mixed components are uniformly very small. Caustic soda, for example, (NaOH) constitutes a handling problem for rig personnel due to its ability to burn flesh, but becomes a salt of a weak acid or is absorbed when mixed into the buffering power of weak acids such as lignosulfonate and bentonite.

4.91 Certain metal compounds are also put into drilling materials, but may not be available for plant or animal uptake because the sodium ion of bentonite readily may be exchanged for ions of potential pollutant metals forming a stable compound. Bentonite, a major mud component, then can serve as an absorbent barrier. Soluble gums, cellulose, and starch are either edible or useful as fibre in human diets. The synthetic polymers are biologically nearly inert because of their high unit weights. Barite, the most used component, is virtually insoluble to the point of being inert. Lignosulfonates have relatively low toxicities among organic compounds, perhaps constituting about the same hazards as equal weights of peat or wood chips.

4.92 Sodium, aluminum, iron and chromium are added to drilling mud. Sodium is added to control pH and enhance the lubricating properties of muds; aluminum, iron and chromium are

TABLE 4-5

BASIC ADDITIVES USED IN DRILLING VARIOUS
WELLS IN THE GULF OF MEXICO AND MID-ATLANTIC

Location of well	Gulf of Mexico					Mid-Atlantic
Depth of well(m)	1,480	2,987	3,175	5,935	6,435	4,974
Fluid additives (short tons)						
Barite	468.0	603.0	511.0	1798.0	1078.0	953.0
Clays	27.0	42.0	117.0	59.0	387.0	454.0
Lignosulfonates	5.0	14.0	12.6	50.0	41.0	53.0
Lignite	3.8	14.0	3.4	2.5	40.7	51.7
Cellulosic polymers	0	0	2.6	15.6	9.4	4.7
Caustic (NaOH)	4.1	39.3	35.1	45.0	140.0	55.2
Soda ash/bicarbonate	1.0	0.3	1.5	2.8	31.4	0
Total additives	520.0	709.0	697.0	2118.0	1724.0	1573.0

Source: Menzie, 1982

TABLE 4-6

CONSTITUENTS OF DRILLING MUDS IN MOBILE BAY

CONCENTRATION*

Constituent	Range	Average
Bentonite	4.0-5.3	4.40
Sodium hydroxide	0.26-0.37	0.29
Barite	0.53-31.1	9.88
Mica	---	--
Sodium acid pyrophosphate	---	--
Polyanionic cellulosic polymer	0.02-0.13	***
Lignite	0.26-0.92	***
Aluminum stearate	---	***
Bentonite extender**	---	***
Sodium polyocrylate	---	***
Sodium bicarbonate	---	--
Ferrochrome lignosulfonate	---	***
Organic polymer	---	***
Organic compounds	---	0.94

SOURCE: McCrory and Williams, 1982, as adapted from Mobil Oil Company.

* All concentrations expressed as percent.

** Copolymer of polyvinyl acetate and malaic anhydride.

*** See combined total under organic compounds.

--- Not calculated.

added for deep drilling depths to control organic compound breakdown and to control sodium effects on betonite. Chemical tests of drilling muds disposed of at licensed facilities on the Mississippi coast and reported to Mississippi Department of Natural Resources, Bureau of Pollution Control have not shown an excessive heavy metal content (Mississippi Department of Natural Resources, 1983a).

4.93 The volumes of various potential polluting materials will depend on rig capacities, the amount of materials used and wastes produced, and the length of time since a service vessel has been to the rig. At full capacity most drilling rigs typical of Gulf of Mexico operations would contain the following:

- 1,250 to 9,000 cubic feet of drill mud and cement;
- 3,360 to 5,000 sacks of chemicals and cements;
- 1,000 to 1,650 barrels of liquid mud; and
- 980 to 2,763 barrels of fuel oil.

4.94 Menzie (1982) estimated based on oil company reports that a typical offshore oil and gas rig would produce approximately 0.7 cubic meters (production phase) to 5.3 cubic meters (exploration and development phases) per day of sewage.

4.95 Mobil Oil Exploration and Producing Southeast, Inc. (U.S. Army Corps of Engineers, Mobile, 1980) estimated in their south Mobile Bay permit application that a 21,500-foot well would generate a total 3,600 cubic yards of drill mud and 1,300 cubic yards of cuttings requiring disposal. The monthly solid fraction volumes were estimated per well during ideal, average, and poor drilling conditions which correspond to drilling durations for a 21,500-foot well of 100, 180, and 420 days, respectively. These estimates are 1,100 cubic yards of mud and 400 cubic yards of cuttings under ideal conditions, 600 cubic yards of mud and 200 cubic yards of cuttings under average conditions and 250 cubic yards of mud and 100 cubic yards of cuttings under poor conditions.

4.96 Records for one well and two sidetracks from an inland drilling barge, zero discharge operation in the Delta indicate a total waste volume of 275,000 barrels for the three holes (Settoon, 1983). This volume is within the range of MOEPSI's permit estimates. Exxon records for drilling a 21,500 foot well in Mobile Bay indicate total waste volume of 150,000 barrels per well, 9,000 barrels of which were cuttings, 6,000 barrels of drilling muds, and 135,000 barrels of water, (Johnson, 1983). Mobil Oil has provided actual experience data from two wells in Mobile Bay that present a

30 percent increase over estimated solid volumes. This and other data from literature review and personal communications are shown in Table 4-7. Using the published or reported data, comparable parameters have been calculated where possible.

4.97 Socioeconomic Characteristics. An inland drilling barge is a self-contained unit with living quarters for the crew. The operation is supplied from onshore service bases via boats, barges and sometime helicopters depending on distance and economy. The principal socioeconomic activity from inland and offshore drilling centers around the onshore bases. Some socioeconomic characteristics from drilling are as follows:

- The local labor pool can benefit on a small scale through the practice of hiring locals adopted by some service companies.

- The use of auxiliary businesses for activities such as marine transport, diving, and possibly minor equipment repairs would benefit area firms.

- Small traffic increases in and around the staging dock would occur with the movement of supplies, and at crew landings where personnel would park their cars.

Below, labor and supply needs with accompanying transportation requirements for operating and servicing an inland drilling rig in the Mobile Delta are detailed.

4.98 Once a site is prepared for an inland drilling rig in the Delta, the barge is tugged to the area and positioned. Usually no more than two tugs with their captains and one to three deck hands are required. The nationwide average estimate indicates these individuals could earn about $460 per week (U.S. Department of Labor, 1983). The tug is generally contracted from a firm in the area where the rig was previously stationed; once the rig is in place the tug is released. A tug can also be contracted from a firm in the area of destination.

4.99 Estimates of crew size on board a self-contained rig vary among sources (Research and Planning Consultants, 1977; Clark et al., 1978; Gladden et al., 1976; Wales et al., 1976). The size of a crew is affected by factors such as the accessibility of shore-based support services and the phase of drilling in progress (Petroleum Extension Service, 1976). Typically between 20 and 36 people would live and work on a barge rig at any one time. Two shifts of 12 hours each during

TABLE 4-7

WELL DRILLING WASTE DATA

(PER WELL BASIS)

Data Source	Drill Mud Weight Tons	Drill Mud Solid Volume BBL	Drill Mud Solid Volume Cu Yd	Cuttings and Sand Weight Tons	Cuttings and Sand Solid Volume BBL	Cuttings and Sand Solid Volume Cu Yd	All Solids Weight Tons	All Solids Solid Volume BBL	All Solids Solid Volume Cu Yd	Liquids BBL	Total Volume BBL
Draft EIS Gulf of Mexico, 1984											
"M" Scenario, Central Gulf, p 192,		3,492*	726		1,947	405*		5,439	1,131	1,066* to 95,902*	6,505 to 101,341
"M" Scenario, Western Gulf, p 194		3,157*	656		1,764	367*		4,921	1,023	1,184* to 106,531*	6,105 to 111,452
Estimated Volume 20,000' well, Shell, Gulf of Mexico, 1978 (Petrazuolo, 1981)	4,183*	16,800*	3,493		6,750*	1,403		23,550	4,896		
Well F, 21,113', Autual Data	1,724*										
Well D, 19,742', Actual Data (Petrazuolo, 1981)	2,118*	6,870	1,428								
Draft EIS Mobile Bay, 1980 Estimated Volumes, 21,500' well (USCOE, Mobile, 1980[a])		17,312	3,600*		6,252	1,300*		23,564	4,900*	23,500* to 100,000 42,000* average	47,064 to 123,564
Superior, Mobile River Delta (Settoon, 1983)											91,700*
Exxon, Mobile Bay, 21,500' well (Johnson, 1983)		6,000*	1,248		9,000*	1,871		15,000*	3,119	135,000*	150,000*
Disposal Systems, Mobile Bay well (Phillips, 1983)								28,850	6,000*	176,150	205,000*
Mobil, Mible Bay 77-1, 20,984' Actual data (Musson, 1983)								40,056*	8,327	184,299*	224,355
Mobil, Mobile Bay 76-2, 20,981' Actual data (Musson, 1983)								39,012*	8,110	165,350*	204,362

*Actual data provided, expressed on a per well basis.

a seven day tour is the norm (Research Planning Consultants, 1977; Wales et al., 1976, U.S. Army Corps of Engineers, 1980). A complement of workers aboard a drilling rig could include the following personnel (Wales et al. 1976):

- Roustabouts - 9
- Floormen - 6
- Derrickman - 1
- Driller and Assistant Driller - 2
- Petroleum Engineer - 1
- Toolpusher in charge - 1
- Barge Engineer and Assistant - 2
- Motormen - 6
- Painters - 3
- Caterers - 3
- Radio Operator - 1
- Sick Berth Attendant - 1

Nationwide in extractive occupations for 1983, individuals earned an average estimated weekly wage of almost $500 (U.S. Department of Labor, 1983).

4.100 Variation in crew composition and numbers is normal. During the life of one well more than fifty separate functions in support activities are required (Wales et al., 1976); fluctuations in personnel result. The type of rig used does not necessarily dictate how many workers are needed. There would be little difference in crew composition and size among different rig types or operations in the Delta, Bay, Sound and Gulf state waters. Current (early 1983) operations in the Delta require a crew of 20 to 25 individuals on board at once during normal drilling procedures. It has been estimated that an additional 10 to 15 people would be required during the height of activity. An operator in Mobile Bay has had 31 people on board, with up to eight additional service personnel added for short periods to perform special tasks (U.S. Army Corps of Engineers, 1980). Since a rig in the Delta is relatively close to shore and supplies, fewer personnel are required than for a distant offshore drilling.

4.101 The installation of a rig on site requires about the same amount of labor as during any other phase of drilling (Settoon, 1983, personal communication; Johnson, 1983, personal communication). Service personnel are periodically added to the constant crew during certain phases (U.S. Army Corps of Engineers, 1980; Wales et al., 1976). At the beginning and end of a seven day tour the old crew is ferried off the rig while a new crew is transported to the operation. A 25 to 30 foot crewboat goes to a nearby landing to drop-off the old and pick-up the new personnel (Settoon, 1983, personal communication).

4.102 Crew members (including caterers) originate from many areas in the country but are particularly concentrated in the Gulf Coast states. They do not change their place of residence with their rig assignments (Wales et al., 1976). As a rule they return to their homes between tours and thus have little if any interaction with the local area housing and community services. Since many crew members would be likely to reside in the Gulf States, including Alabama, many would commute by car to the landings.

4.103 Service and supply requirements for an inland drilling barge are essentially the same as for other offshore rigs. Most services are contracted out to specialized service companies (Wales et al., 1976). The following services are representative of the activities associated with an offshore rig (Wales et al., 1976):

- Mud supplier
- Wireline company
- Logging and perforating company
- Fishing tool company
- Wellhead equipment company
- Cementing company
- Diving service

The transfer of materials is from an onshore staging area and is a continuous activity during drilling (Havran and Collins, 1980). Prior to a commercial hydrocarbon find, onshore activities are generally limited to the port-centered servicing requirements of loading barges with drilling equipment, pipe, chemicals, muds, food supplies and the like (Havran and Collins, 1980).

4.104 The location of existing service companies dictates the need to establish a temporary or permanent facility near drilling operations (New England River Basin Commission, 1976). Throughout the Gulf of Mexico region there are numerous areas where activities associated with the offshore oil and gas activity have concentrated. Houston and New Orleans are dominant centers with New Orleans specifically servicing the needs of offshore operators (Havran and Collins, 1980). Smaller centers of oil and gas service activity are located in several cities throughout Texas and Louisiana. Offshore oil and gas related functions are not dominant but are apparent in other Gulf cities including Pascagoula, Mississippi (Havran and Collins, 1980). Alabama, although mostly undeveloped offshore oil and gas territory compared to its neighbors to the west, does house some service facilities. A few, like mud and cement companies that cater to the offshore industry currently have facilities located in the Mobile area; they primarily support land based operations (South Alabama Regional Planning Commission, 1981d).

4.105 With the sophisticated network of offshore service and support business close to the Delta region, it becomes a question of cost, in many instances, of whether to truck some supplies to a staging dock or barge them directly to a rig from Texas, Louisiana or Mississippi sources. These two options generally prove to be preferred for an area close to existing infrastructure and in the fledgling stage of development rather than establishing new facilities.

4.106 It is preferable that all of the supplies and personnel be the least time and distance from the rig as possible (Wales et al., 1976). Thus, personnel are transferred from a nearby Delta landing, while the Port of Mobile serves as a staging area for supplies. It is served by a well-developed system of roads and rail capable of transporting supplies to a dock for subsequent barging to a rig site.

4.107 During drilling activities, operating companies are likely to lease existing port facilities as temporary bases (Weston, 1978). For instance, Delta operations have been staged from a dock owned by a mud supplier at the Port of Mobile. It is traditional for mud companies to establish support bases (Clark et al., 1978) which are subsequently used often by several operators. Personnel at the dock currently serving the Delta are few. There is one dispatcher from the local area and about 15 other employees, some of whom are involved in loading materials onto barges for transport to the rig (Settoon, 1983, personal communication). It is typical for a mud company to employ between four and 15 people, and most of these organizations have a policy of hiring local labor whenever possible (Havran and Collins, 1980). This aspect of drilling, therefore, can result in a minimum number of local hires. It does not significantly affect housing or community services as the local individuals are already established, and those who move to the area are few in number.

4.108 In the case of existing Delta operations, the proximity of material suppliers in Louisiana and Texas allows some items to be barged directly from the supplier to the site, while other materials are transported by land and pass through the Mobile dock. Two factors influence the decision to barge directly or transport by land and then barge up river; expense and fragility of the materials. Since the dock is operated by the mud supplier the muds and other items such as fuel, water and food are loaded onto barges at the water side. Tubular goods and some equipment are transported directly from Louisiana via the intracoastal waterway. The least amount of handling that some of the equipment receives is best due to the fragility of parts (Settoon, 1983, personal communication).

4.109 Barges can be expected to move up and down the river taking supplies to the rig and bringing back wastes for disposal throughout the drilling operation . Drilling activities during 1982 and 1983 are fairly typical. Five to six barges are used for supplies and waste. Trips between the dock and rig are often linked. For instance, an empty waste barge moored at the dock could be barged back up river with a supply vessel. An average of one barge trip is made each day. One tug is permanently employed in barging the vessels along the river. However, in the event of stimulated well activities, such as during well completion, another local tug would also be used on a short-term basis.

4.110 Local employment and businesses can directly and indirectly benefit from certain sporadic activities associated with a drilling operation. An example is an operation in the Delta where during times of high water a local diving firm was used to investigate underwater portions of the rig (Settoon, 1983, personal communication).

4.111 Catering is another area of activity that does not require specialists directly associated with the oil and gas industry. These services are often sub-contracted out by the drilling company. Skills required in catering are essentially food preparation and housekeeping, tasks which area firms could perform. For each rig this could amount to between one and ten jobs (Havran and Collins, 1980). Certain equipment repairs could also be performed by area firms, as could security services.

4.112 Services associated with drilling activities that are not available in the Mobile area are readily available in the neighboring states. Requirements for one rig would not warrant a company moving the short distance, or a new firm emerging on the local market.

4.113 Navigation. Waterway traffic due to routine operations would include an inland drill barge, tugs with mud or supply barges, crew boats, small craft, and, possibly, seaplanes. The inland drill barge would make one trip from its port of origin to the drilling location and then return following completion of the drilling operations. The tug bringing the drill barge would return after the barge was on station and a second tug would come up the Delta to move the drill barge. The transport of waste drilling fluid and cuttings and the delivery of supplies would require approximately one barge trip per day. Waste drilling fluid would be delivered to a Gulf Coast treatment or disposal site and supplies would be delivered from the Louisiana area or the Mobile area. The tug moving the empty waste barges back to the drill station will often also deliver supplies such as cement or drilling mud. Although the

crew changes once a week, the crew boat will make additional trips between the drilling location and a local boat landing. As many as three trips per day may be made by the crewboat. Small craft are used in the access canal to open and close the oil spill boom when the crew boat or barges are entering or leaving the drilling location. Such craft may make occasional trips to the local landing but not on any regular basis.

River Bank Location for Inland Drilling Barge

4.114 An inland drilling barge could be placed in a slip dredged into the bank of the river channel and directional drilling used to reach the subsurface geological target if it were not directly under the barge location. This method would reduce the amount of wetland area removed compared to the canal and slip method.

4.115 Not all parts of the Delta would be accessible from a river bank using directional drilling. The maximum lateral deviation of the bottom location of a well that can be achieved with current drilling technology is about one mile at the 17,000 to 18,000 foot depth of the Smackover and Norphlet formations, the deepest formations of interest in the Delta. One of the other methods described in the Drilling section would have to be used where a river bank location was not feasible.

4.116 A typical site plan that might be used for a river bank slip for a drilling barge is shown in Figure 4-2. Personnel and supplies would be brought to the drilling location by boat and barge and, occassionally, by helicopter and seaplane. Additional descriptions of the use of a drilling barge are given in Appendix A.

Site Preparation

4.117 Preparation of the drilling site would require clearing of trees from the area, dredging of a slip, preparation of a foundation for the drilling barge to rest on, and construction of a keyway at the well site.

4.118 Water Quality. Dredging of the slip would produce essentially the same types of water quality impacts as those described for dredging a canal and slip. As turbidity would increase, nutrients, organics, and trace metals may be released to the water column which could result in dissolved oxygen sags, a decrease in productivity (from reduced light penetration), or an increase in productivity (from increased nutrients). The volume of sediments dredged and the duration of dredging may be less than for a canal and slip depending upon the levee elevation needed at the river bank as compared to the length of a proposed canal.

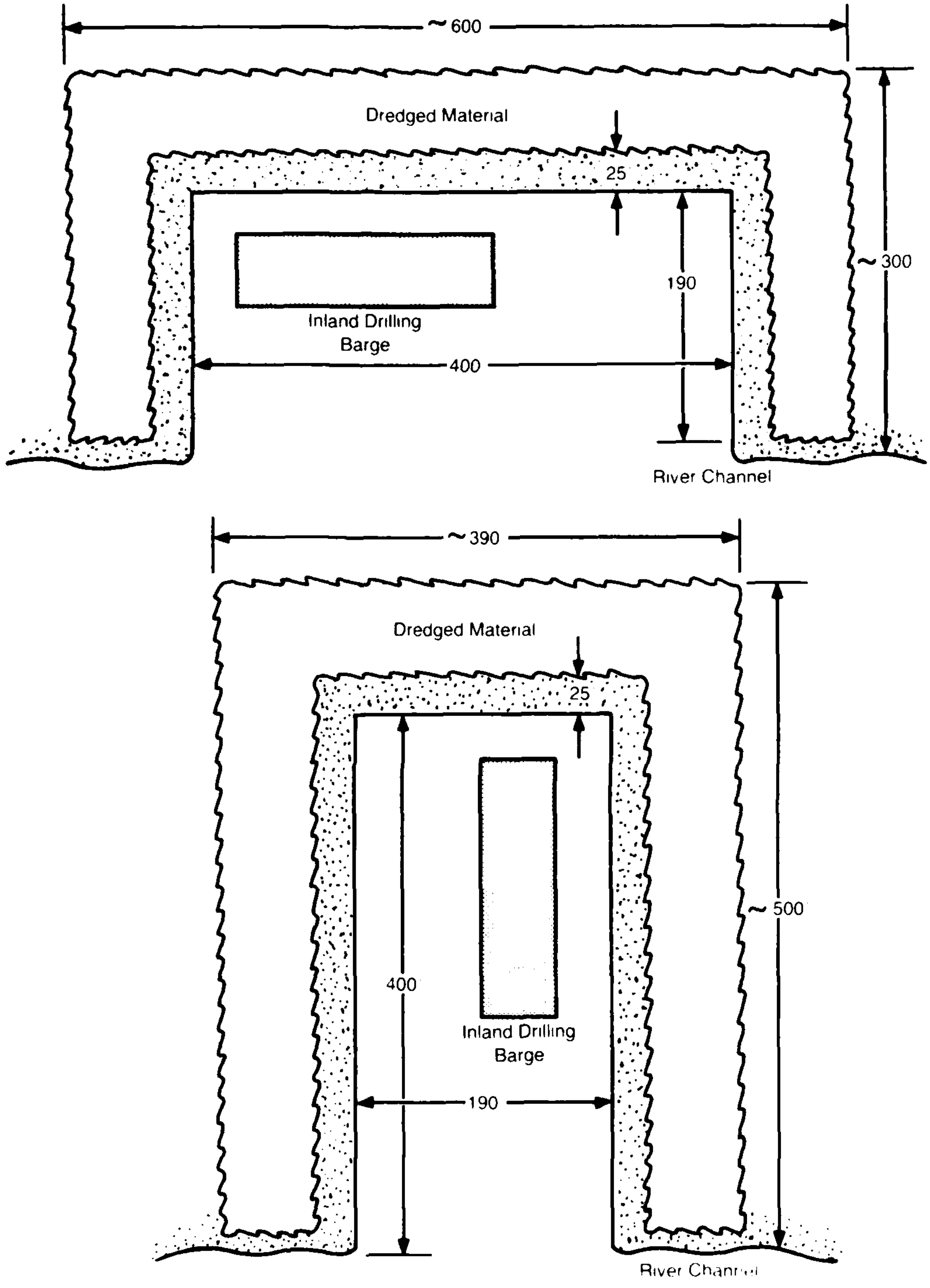

FIGURE 4-2
SLIP SITE PLANS THAT MIGHT BE USED FOR AN INLAND BARGE RIG AT A RIVER BANK LOCATION IN THE MOBILE DELTA

4.119 Hydrology. Dredging of a slip at a river bank would only result in circulation eddies in the slip and in the river channel for a distance of a few hundred f·et downstream of the slip. The magnitude of effects on circu..ation would be less during periods of low flows in the river channel than at other times.

4.120 Wetland Ecosystems. The river bank location would require the dredging of a slip directly in the river bank to accommodate the drilling barge, supply and waste barges, and tug and crew boat. As with a canal and slip, the dredged material would be stored around the cut for later restoration. The dimensions of the cut would be basically the same as for a slip in a canal and slip system and the cut could be oriented with the long dimension of the slip parallel to or perpendicular to the river channel. The total area disturbed would be about 4 acres (4.121 cres for a slip perpendicular to the river and 4.122 cres for a slip parallel to the river). Approximately half of this area would be in open water and the remaining half would accommodate the dredged material and the set-back berm.

4.123 Aquatic Ecosystems. Dredging of the river bank slip and adjacent submerged river bottoms would destroy benthic communities in the dredging and disposal area and possibly affect aquatic organisms in the vicinity by turbidity resulting from resuspended sediments. The effects for this alternative would be similar to those for the canal and slip system.

4.124 Groundwater. Potential groundwater effects would be basically the same as described for the canal and slip alternative: altered circulation and drainage and potential alterations to groundwater quality in the uppermost portions of the alluvial aquifer.

4.125 Air Emissions. Air emissions associated with this alternative are shown in Table 4-3.

4.126 Noise. Preparation activities would be similar to the canal and slip inland drilling barge alternative. Dredging may or may not be necessary and land clearing and earthmoving activities (Appendix E) may be more intense if the river bank is forested and ridged. Chain saws (average dBA at 50 ft. = 83: Berkau et al., 1975; 100 dBA, presumably at operator's position: New England River Basin Commission, 1976) may be needed for initial clearing.

4.127 Solid and Hazardous Wastes. The nature of wastes generated for this alternative are similar but generally less than those generated by the canal and slip access alternative. A smaller

area is cleared and dredged for this alternative and crews and equipment are on site for a shorter period of time.

4.128 Socioeconomic Characteristics. A river bank location for an inland drilling barge would involve the same activities described for a canal and slip location. The difference would lie in the time over which the clearing and dredging would occur. A smaller area is needed for this alternative, so the work could take less time if the river bank were not significantly higher than the adjacent wetland.

4.129 Navigation. The additional waterway traffic from a drill barge in a river bank cut would be essentially the same as that for a canal and slip system. During site preparation, there would be one round trip between the site and the port of origin for the tugs with the barge-mounted dredge and the barge-mounted pile driver. There would also be one trip for the tug delivering the dredge and the second tug returning the dredge. Crew boat traffic would be about one trip per day between the site and a local boat landing. Total crew boat trips would be a bit less since the area for an access canal need not be cleared.

Routine Operations

4.130 The effects associated with the routine operation of a drilling barge in a river bank slip would be the same as those discussed for operation of a canal and slip system. If the slip is located along the Mobile River, there could be some slight affect on navigation because of the mooring of support vessels within the natural river channel. Circulation in the slip would be greater because of the wider mouth of the slip being adjacent to a waterway and this would maintain a higher dissolved oxygen level in the slip and tend to flush out organic material and nutrients that could have otherwise accumulated. Containment of spills could be more difficult for this alternative.

Inland Drilling Barge in the River Channel

4.131 An inland drilling barge could be placed at a drilling site at the edge of a natural channel in the Delta and directional drilling carried out to reach a geological target located beneath wetland areas. This drilling method would not disturb any wetland area. This alternative could not be used everywhere because of rapid increase in depth away from the river bank in many channels within the Delta. Some dredging within the river channel may be required. A possible site plan is shown in Figure 4-3.

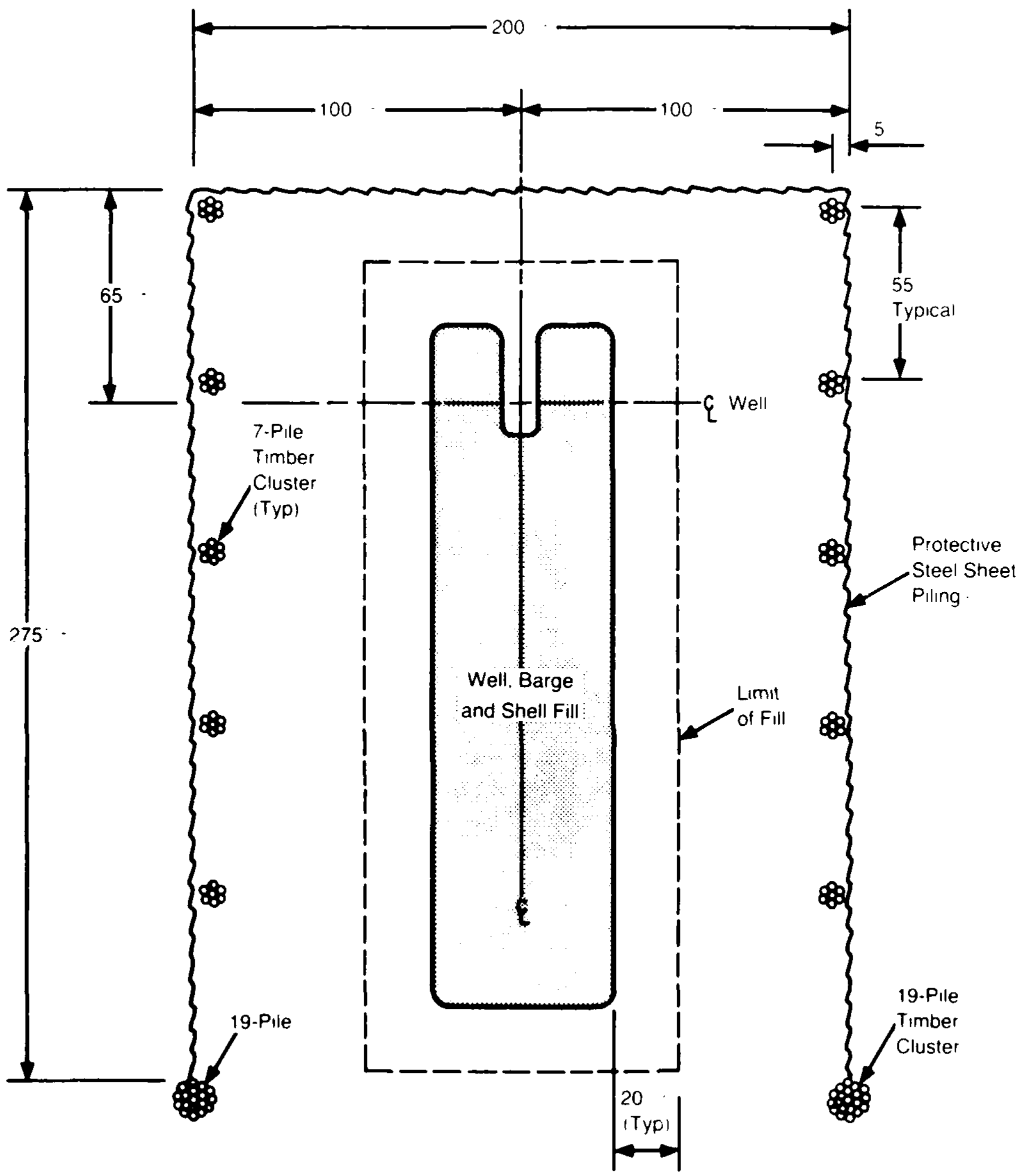

FIGURE 4-3
POSSIBLE SITE PLAN FOR USE OF AN INLAND DRILLING BARGE AT A RIVER CHANNEL LOCATION IN THE MOBILE DELTA

4.132 Not all parts of the Delta would be accessible from a river channel location using directional drilling from a river channel location. The maximum lateral deviation of the bottom location of a well that can be achieved with current drilling technology is about one mile at the 17,000 to 18,000 foot depth of the Smackover and Norphlet formations, the deepest formations of interest in the Delta. One of the other methods of drilling site access would have to be used where a river channel location was infeasible.

4.133 Personnel and material would be brought to and from the drilling location by boat and barge, and occasionally, helicopter and seaplane. Additional descriptions of the use of a drilling barge are given in Appendix A.

Site Preparation

4.134 Site preparation would require preparing of the river bottom to accommodate the barge and support vessels and of construction of the sheet pile structure and mooring structures.

4.135 Water Quality. Turbidity would increase from placement of the shell pad for the barge foundation and from sheeting and pile driving. The sheeting is designed to protect the rig from boating accidents and floating debris and to minimize erosion of the foundation pad. The amount of sediments that would be suspended during site preparation would be relatively small and would be quickly dispersed by river currents. A secondary benefit of the sheeting is to inhibit spill migration.

4.136 Hydrology. Water is diverted to both sides of the barge by sheet piles. Circulation eddies would form within the river channel and alter circulation for a distance of a few hundred feet downstream of the barge. As for the river bank drilling option, effects on circulation would be most obvious when velocities of water in the river channel are highest (i.e., high flow periods when water is not spread throughout the floodplain).

4.137 Aquatic Ecosystems. Aquatic ecosystems would be affected by the loss of benthic habitat while the barge remained in place and from the turbidity resulting from preparation of the site to receive the drilling barge. The benthic area covered by the barge or shell pad on which the barge may rest would be small, about 1/4 acre. This benthic area would be lost for a period that could vary from only a few months for a single shallow well to several years if several deep wells are drilled.

4.138 In most of the Delta, no access channel to the drilling site would be required because the existing depths are adequate for access to the site. In the shallow bays of the southern Delta, an access channel would be required. Benthic area disturbed by this dredging would be 3 to 4 acres per 1000 feet of channel length, assuming that dredged material placement adjacent to the channel requires about the same width as the channel. Recolonization of these areas would begin immediately and require up to 2 years (see discussion of canal and slip alternative).

4.139 Turbidity resulting from site preparation would be short term and of limited extent in most of the Delta. In the shallow bays of the treeless southern Delta, turbidity would last longer because of the need to dredge an access channel (see discussion of canal and slip alternative).

4.140 Wastewater Disposal. Treatment and disposal of wastewater would be the same as for the canal and slip drilling alternative. The no-discharge rule would apply for the delta; all wastewater and runoff from well sites would be transferred to a designated upland location for treatment and disposal.

4.141 Groundwater. Potential groundwater effects would be basically the same as described for the canal and slip alternative: altered circulation and drainage and potential alterations to groundwater quality in the uppermost portions of the alluvial aquifer.

4.142 Air Emissions. Air emissions from this alternative are shown in Table 4-3.

4.143 Noise. Preparations would not involve land clearing but may involve some improvement dredging before drilling barge on-site placement. Noise associated with mooring of the barge and transportation of the barge along the river with tug boats would be similar to the previously-described activities for the canal and slip inland drilling barge alternative.

4.144 Solid and Hazardous Wastes. Wastes generated by this alternative are similar in type to those of the canal and slip alternative, with the major exception of the dredging activity being replaced with a shell pad placement activity. Duration and intensity of this alternative would be most similar to the inland barge river bank location alternative.

4.145 Socioeconomic Characteristics. Installation requirements for an inland barge in the river channel are fewer than for the alternatives involving clearing and dredging a site for a

canal and/or slip. Clearing is not necessary; however, piles would be needed for a sheet pile barrier designed to contain spills and protect the rig. The procedures required for this activity would be the same as those in Mobile Bay and Mississippi Sound described in Chapter 5.

4.146 Navigation. The additional waterway traffic from site preparation would be essentially the same as that for a canal and slip: a barge-mounted dredge and pile driver, various supply boats or barges, crew boats and some small craft used for site inspections. The operation of the dredge and pile driver in the river could affect area navigation. Although an established navigation channel exists for the Mobile River, traffic navigating the outside curve of a bend or meander will often pass close to the shore, outside of the marked channel. Such conditions, particularly with the commercial traffic on the Mobile River, would produce an accident between the river traffic and any work vessels moored in the river.

Routine Operations

4.147 The effects associated with the routine operation of a drilling barge in the river channel would be the same as discussed for the canal and slip alternative. Because of the presence of moored vessels in the river channel under this alternative, the hazard to navigation would be increased, especially in the Mobile River. A navigation accident at a moored drilling barge would present problems regarding spill containment. The presence of a structure in the river channel would have a local effect on river current. In areas of low river velocity around the sheeting, suspended sediments may settle out of the river water. In areas of high river velocity around the sheeting, scouring may resuspend sediments. The amount of scouring and settling would be determined by the orientation of the sheeting relative to the river flow.

Fixed Drilling Platform with Canal Access

4.148 The use of a fixed platform for drilling operations at a well site and a canal for site access would reduce the wetland area altered compared to the canal and slip method. A possible site plan for such a system is given Figure 4-4.

4.149 The platform would serve as the support for a modular drilling rig transported to the site on barges. Because a large inland drilling barge would not be used, a narrower access canal (65 feet) can be used for the service vessels and barges. Widths less than 65 feet are possible if smaller barges are used.

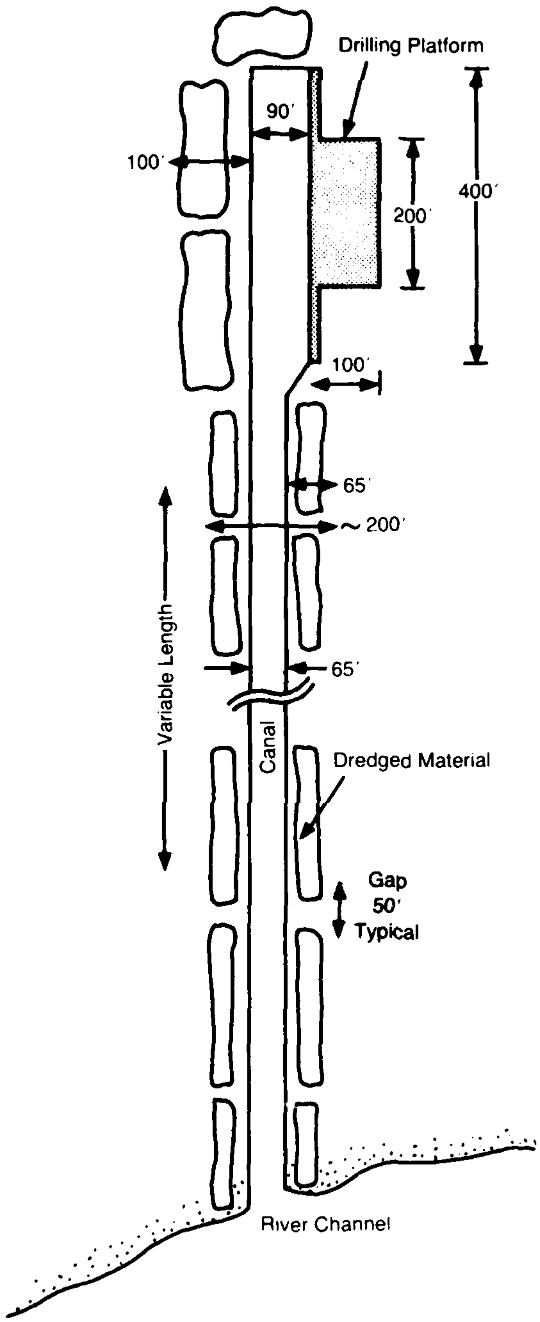

FIGURE 4-4
POSSIBLE SITE PLAN FOR USE OF A FIXED DRILLING PLATFORM WITH CANAL ACCESS IN THE MOBILE DELTA

4.150 Operation of the site would be as a typical land drilling operation with two or three crew shifts per day. Personnel would return home or stay at a local motel or in a camper vehicle when off duty. A crew boat would shuttle crew members to and from a local landing site and the drilling site at shift change. The drilling company supervisor (tool pusher) and the oil company representative (company man) would live in quarters on the platform. Materials would be taken to and from the site by boat or barge. Additional descriptions of this alternative are given in Appendix A.

Site Preparation

4.151 Site preparation would consist of clearing of the area, dredging of a canal and construction of a platform.

4.152 Water Quality. Impacts to surface water quality and hydrology would be similar to those described for a canal and slip for an inland drilling barge. Because a self-contained drilling barge is not used, the canal and slip are not as wide as the canal and slip for an inland drilling barge. Therefore, the total amount of sediments resuspended during dredging would be less for a canal and slip for a fixed drilling platform than for a canal and slip for an inland drilling barge. Also, there is no shell pad foundation placement in the slip for a fixed drilling platform.

4.153 Hydrology. Effects of an adjoining canal on circulation within the river channel has been discussed for the canal and slip drilling alternative. Eddies would form and extend in the river channel only as far as a few hundred feet downstream of the dredged slip. Waters within the slip would move quite slowly, except possibly if a canal is dredged at the outer bend of a river channel or if multiple canals are interconnected.

4.154 Wetland Ecosystems. The canal portion of this alternative would be basically the same as the canal for the canal and barge slip alternative described earlier. However, since the canal need only accommodate normal width barges and not the wider inland drilling barge, the central channel is dredged to only a 65 foot width at water level. The dredged material is stockpiled on both sides of the channel for later restoration efforts. For each 1000 feet of canal approximately 4 1/2 acres would be altered: 1 1/2 acres by actual dredging and the remaining 3 acres by clearing for the set back berm and the stockpiled dredged material.

4.155 The portion of the canal adjacent to the platform and its docking extensions (about 400 feet) would be widened to about 90 feet wide to allow boat and barge maneuvering. About 2 1/4 acres

would be disturbed (3/4 acre by dredging and about 1 1/2 acres for dredged material placement).

4.156 The drilling area would not be dredged but would be altered by the removal of vegetation to provide an area for construction of the platform to support the drill rig. For this alternative, typically an area 100 feet by 200 feet (1/2 acre) would be cleared to allow construction of the platform. On both ends of the platform, an area of 20 feet by 100 feet would be cleared for construction of pile-supported barge and boat off loading docks. For such a platform, wooden piles would be enplaced with a spacing varying from 4 feet to 12 feet. The construction of a 2000 foot canal, turning slip and drilling platform would disturb a total of 11 3/4 acres of wetlands.

4.157 Wetland area would be lost from the area of the canal and the adjacent dredged material during the site preparation period. All woody vegetation would be removed from the area of the platform prior to construction. Equipment used in the construction of the platform would probably crush most of the shrubs at bottomland hardwood platform sites if built using piledrivers fitted with large treads for use on soft wetland surfaces. This would not occur if the platform was built from "on top" (the piledriver would work from the platform itself as the decking was extended to each new row of piles). In the area of emergent wetland vegetation in the southern treeless portion of the Delta, the vegetation would merely be covered by the platform since it would probably be built from "on top."

4.158 Aquatic Ecosystems. Dredging of the access canal would result in the destruction of benthic communities at the mouth of the canal. The amount of benthic area disturbed would be about 1/4 acre per 100 feet of channel leading to the canal entrance.

4.159 Turbidity would result from dredging operations. The potential effect of turbidity has been discussed for the canal and slip alternative.

4.160 Wastewater Disposal. Treatment and disposal of wastewater would involve the same procedures as discussed previously for the canal and slip drilling alternative. The no-discharge rule would apply for delta well sites. Coast Guard regulations would apply for vessels.

4.161 Groundwater. Potential groundwater effects would be basically the same as described for the canal and slip alternative: altered circulation and drainage and potential alterations to groundwater quality in the uppermost portions of the alluvial aquifer.

4.162 Air Emissions. Air emissions associated with this alternative are shown in Table 4-3.

4.163 Noise. Clearing preparations for drilling platforms would be similar to those for inland drilling barges. Canal dredging would also be similar. Fixed drilling platform implementation would involve transportation of components, supplies, and personnel to a given site using tugs/barges, motorboats, and possibly larger crewboats (see Appendix E). Heavy transport helicopters (70-90 dB at 1,000 feet: New England River Basin Commission, 1976) could alternatively be used for rig component transport. Fixed platform construction would involve several operations previously described, including the operation of mobile cranes from land or from barges in the dredged canal. Various other noise sources would include pile drivers, compressors, generators, trucks, pneumatic tools, and the like. Additional noise may emanate from metal impacts perhaps comparable to industrial metal forming activities.

4.164 Fabrication of steel and concrete drilling platforms relative to noise levels have been reviewed by the New England River Basin Commission (1976) and include such noise sources as pneumatic tools, metal forming activities, cranes, industrial trucks, concrete mixers, and concrete pumps (Appendix E).

4.165 Solid and Hazardous Waste. Solid waste generated by this alternative would be similar to the canal and slip alternative and limited to trash and construction debris. Less dredge material and biomass would remain on site for this alternative.

4.166 Socioeconomic Characteristics. Local businesses have an opportunity to participate in at least four activities related to this alternative: clearing the area to be dredged, constructing the deck structure in modules at a yard, driving the piles on whic the platform for a modular drilling rig would be placed, and erecting pre-fabricated parts. The effects from clearing and dredging are described under the canal and slip alternative. The labor requirements and influence on the local area from erecting a platform for a modular rig are described in the following paragraphs.

4.167 Initially, the platform could be constructed in modules at a platform fabrication yard in Alabama, Mississippi, Louisiana or Texas, and barged to the drilling site. There would be no effect on the local area if the contract went to an out-of-state firm. However, if an Alabama firm were awarded the contract, employment for at least 30 people for several weeks could result from constructing the modules alone (Ernest, 1983, personal communication). Skilled labor such as structural metal workers,

carpenters, welders and heavy equipment operators could be used. Wages for such skilled labor, based on 1983 nationwide averages could vary from over $500 per week for structural metal workers to ahbout $320 per week for carpenters (U.S. Department of Labor, 1983). Before the structure was barged to the drill site, the area would be cleared, and piles driven, as previously described. A crew of six could clear between 1 and 2 acres per day. The pile driving (about 300 wood piles) would take about two weeks (Ernest, 1983, personal communication). The installation of the platform would require the use of a floating crane or derrick barge to lift the modules. While the water transportation occupations earn an estimated average of $460 per week, crane and tower operators nationwide earn bout $410 per week and those working with hoists and wenches earn about $480 weekly (U.S. Department of Labor, 1983).

4.168 Once the platform is erected components of a modular drilling rig could be barged in. Rig crew members from all shifts would then assist in rigging up.

4.169 Navigation. The additional waterway traffic from this alternative would be essentially the same as that for a canal and slip, as described above: one round trip between the site and the port of origin for the barge-mounted dredge, several barge loads of equipment (pile driver, barge-mounted crane, piles, construction timber, drill rig modules), and a daily crew boat trip between the site and a local landing for the clearing and construction crew.

Routine Operations

4.170 Once the platform was in place and the drilling rig assembled, drilling of the well would commence.

4.171 Water Quality. Impacts to surface water quality due to routine operation of a fixed drilling platform with canal access are the same as those described for an inland drilling barge with canal access.

4.172 Hydrology. Effects on hydrology during routine operations would be the same type and magnitude as described previously for the canal and slip drilling alternative. Some eddies would form in the river channel and in the portion of the canal near the river channel. Circulation within the canal would be sluggish.

4.173 Wetland Ecosystems. The wetland area within the canal and adjacent material deposition area would be lost and biological productivity of the area under the platform would be greatly reduced or eliminated for the duration of drilling at the site. The effect

of wetland area lost to the canal and dredged material would be the same as discussed for the canal and slip alternative.

4.174 Biological productivity of the area under the platform would be greatly reduced because of the lack of large woody species and trees, the necessity to recover from disturbances resulting from platform construction and the reduced insolation because of shading by the platform. Under low platforms it is possible that insolation would be insufficient for the growth of any vegetation. Although productivity would be reduced under the platform, some habitat value would remain because the soil surface would not be removed. The area would still be available to wetland invertebrates and small vertebrates and to fish and other aquatic species during periods of inundation. Because of the human activities at the site, it is unlikely that larger vertebrates would utilize the area to any significant extent. Because of the reduced primary productivity of the site, secondary production of animal tissue would be reduced. The contribution of detritus to the Delta aquatic ecosystem would also be reduced.

4.175 Aquatic Ecosystems. During the routine operation of the drilling site, aquatic ecosystems would be affected in the same way as described for the canal and slip system alternative. Because of the smaller canal needed for the drilling platform alternative, only 1 1/2 acres of aquatic habitat per 1000 feet of canal would be created.

4.176 Wastewater Disposal. Treatment and disposal of wastewater would involve the same procedures as discussed previously for the canal and slip drilling alternative. The no-discharge rule would apply for delta well sites. If drilling personnel do not reside at the rig site for a few days at a time, quantities of sanitary wastes would be 10 to 15 gallons per day rather than 30 to 40 gallons per day.

4.177 Groundwater. The potential groundwater effects associated with the routine operations of a drilling platform with canal access would be the same as those discussed for routine operations of a canal and slip system.

4.178 Air Emissions. Air emissions associated with these activities are shown in Table 4-3.

4.179 Noise. Primary noise producing activities would be the actual well drilling. The noise attenuation distance might be somewhat longer than barge rigs since platforms are more elevated. Additional noise sources would be motorboats, crewboats, tugs for waste disposal barges, and maintenance rig operations.

4.180 Solid and Hazardous Wastes. The volumes and constituents of solid waste generated during drilling on a fixed platform with canal access would be similar to that described for an operation using a canal and slip and inland barge.

4.181 Socioeconomic Characteristics. Approximately 8 to 10 people would be required per shift to operate a modular rig; it is run as a conventional land rig. The length of time these people would be in the area is dependent on the depth of the well. Most crews working on land rigs consist of the following (Baker, 1979):

- Toolpusher
- Driller
- Derrickman
- Two or three floormen
- Motorman
- Rig mechanic
- Rig electrician

Personnel such as a mud engineer and mud loggers are also on site; casing crews and cementing services would be required at certain times. On the average those involved in the extractive occupations nationwide earn about $500 per week (U.S. Department of Labor, 1983).

4.182 Drilling proceeds for 24 hours a day; there are generally three eight-hour shifts. A fourth crew fills in as needed (Baker, 1979). In developed areas to the west of Alabama, land rig crews living within about 100 mile radius commute to their rig on a daily basis (Grisham, 1983, personal communication). Beyond 100 miles, a commuting crew member may weigh several factors prior to making a decision to move (Grisham, 1983, personal communication). The choice would be based on conditions such as employment opportunities closer to home, the apparent longevity of the more remote rig operation, and the likelihood that the distant area would be one that promised long term exploration, development and production.

4.183 A commuting distance of 100 miles from the Mobile area extends into Louisiana, Mississippi and Florida, where many oil field operators are located. This commuting distance coupled with the existence of other land drilling operations in Mobile and Baldwin counties suggest that most members of a land operation in the area would commute to the site on a daily basis. It is also possible that some crew members would already be residents of Mobile or Baldwin counties. Thus, the only effects that may result from the use of a modular rig or a conventional rig in the Delta would include a slight increase of traffic at the meeting point, and minor retail purchases as commuters go and come to the site. There would be little if any interaction with the housing market, community

services, or land use. However, if the area proves to contain extensive hydrocarbon resources and undergoes long term production, inmigration could result.

4.184 Navigation. Although essentially the same in general operations as the canal and slip with drill barge, the platform rig would be operated as a typical land drilling operation with three crew shift changes per day. Crew boats would shuttle crew members between the drilling site and a local landing three times a day. If medium size crew boats are used, two round trips would probably be needed for each shift change for a total of six trips per day. (Because of the many boat landings presently in the Delta, the distances between possible drilling sites and local landings would generally be less than five miles and thus the very large crew boats required by the long distances in the Gulf are not needed.) With additional crew boat trips for delivering other personnel and small supplies, the crew boats could average 9 or 10 round trips per day.

Fixed Platform with Trestle Road Access

4.185 The construction of a trestle road as access to a fixed drilling platform would eliminate the wetland area disturbed by the use of a canal for access. The trestle road would connect the platform to the nearest navigable natural channel or to adjacent uplands. A possible site plan is given in Figure 4-5.

4.186 To reduce the needed design capacity of the trestle road, it is assumed in this alternative that only well site servicing vehicles and components of a modular drilling rig would be transported on the trestle road. The drilling rig would be moved to and from the site by barge or truck (if access from adjacent uplands is possible). A mooring for barges and boats would be constructed on the channel bank at the end of the trestle road at a site requiring water access.

4.187 Operation of the drilling site would be like a typical land operation as described for the previous alternative. Additional descriptions of this alternative are given in Appendix A.

Site Preparation

4.188 Site preparation would consist of clearing of the construction area, construction of the platform, trestle road and mooring area, and transport and assembly of the drilling rig.

4.189 Water Quality. If access to the trestle road is from a navigable channel, then mooring piles are driven at the river bank and a barge is moored to serve as a dock. Driving of the piles

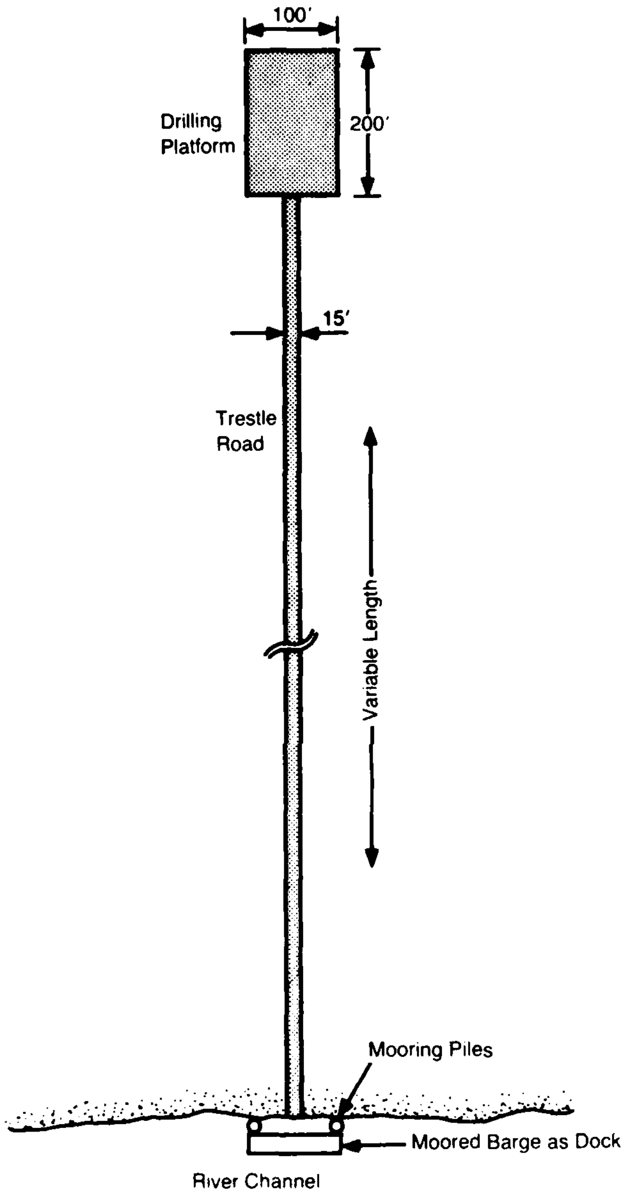

FIGURE 4-5
POSSIBLE SITE PLAN FOR USE OF A FIXED DRILLING PLATFORM WITH TRESTLE ROAD ACCESS IN THE MOBILE DELTA

would cause some turbidity and have a creosote residue as described previously. Water quality impacts due to boat traffic would be the same as for an inland drilling barge in the river channel.

4.190 Hydrology. Circulation within the river channel would be disrupted only in a localized portion of the channel adjacent to a moored barge. Water levels in the river channel would not be altered assuming the barge does not cover a significant portion of the width of the river channel. Circulation eddies would extend only a few hundred feet downstream of the moored barge.

4.191 Wetland Ecosystems. Effects on the wetland ecosystem would result from the removal of larger woody vegetation and trees from the area of the trestle road and platform and from surface disturbance if construction machinery is operated directly on the cleared land. These effects have been discussed for the drilling platform and canal alternative. For the trestle road, vegetation would be cleared from a strip approximately 40 feet wide to accommodate the road and provide sufficient clearance from adjacent trees. For each 1000 feet of trestle road, an area of about 1 acre would be cleared. The area required for the platform would be about 1/2 acre.

4.192 Aquatic Ecosystems. Aquatic ecosystems would be affected only slightly by temporary turbidity resulting from the driving of piles during the construction of mooring facilities in the natural waterway and by propwash of vessels in the vicinity of the mooring facility.

4.193 Wastewater Disposal. Treatment and disposal of wastewater would involve the same procedures as discussed previously for the canal and slip drilling alternative. The no-discharge rule would apply for delta well sites.

4.194 Wastewater could be transported via tank trucks or a temporary pipeline parallel to the trestle road to a waste barge at a river channel or to a tank truck at an upland site depending upon where the trestle road terminates.

4.195 Groundwater. Potential groundwater effects would be basically the same as described for the canal and slip alternative: altered circulation and drainage and potential alterations to groundwater quality in the uppermost portions of the alluvial aquifer. However, the elimination of wetland dredging would minimize any potential effects to groundwater resources from dredging.

4.196 <u>Air Emissions</u>. Air emissions associated with this alternative are shown in Table 4-3.

4.197 <u>Noise</u>. For this unit action alternative, no dredging would be necessary. Trestle road construction over Mobile River Delta wetland/marsh areas would be necessary, however, for drilling platform construction and rig access during routine operations.

4.198 Preliminary land clearing would be similar to earlier descriptions, although some specialized all-terrain wetland equipment would be needed. Transport of drilling rig components would be accomplished by heavy-duty trucks via the trestle road or by transport helicopter. Platform construction would also be similar to the fixed drilling platform with canal access alternative described above.

4.199 Trestle road construction would also involve industrial trucks or helicopters for equipment transport, chain saws for beam trimming, mobile cranes, generators, pile drivers, and basic construction tools. Supplies and wastes would be transported by truck. General noise levels are shown in Appendix E.

4.200 <u>Solid and Hazardous Waste</u>. Site preparation under this alternative would require no dredging. Solid waste generated would be limited to cleared vegetation, trash, construction debris, and fuel and lubricant spills from vehicles, cranes, and pile drivers.

4.201 <u>Socioeconomic Characteristics</u>. The labor requirements and socioeconomic effects from the construction of a platform to support a modular rig were described under the alternative of a platform with canal access. The difference with this alternative (fixed platform with trestle road access) lies with building a trestle road. Labor needs and effects from this activity are described below.

4.202 Between 20 and 25 jobs would be generated by building a 12- to 15-foot-wide trestle road in the Delta. The labor could be local or out of state depending on the firm awarded the contract and its hiring practices. A minimum of 12 workers would be needed to build the structure while at least 8 more would handle supplies at a staging area and shuttle materials by truck (Maxwell, 1983, Personal communication).

4.203 A walking crane with a boom could serve to drive the piles and do the necessary lifting. This operation would require a crane operator. In addition, a bolting crew could be needed to bolt and brace the bents (a row of piles). Other labor would be needed

for constructing the deck; one supervisor would oversee the project (Maxwell, 1983, personal communication).

4.204 The supply end of a trestle road operation would require a staging area for material storage with about six employees and a small hydraulic crane. It has been estimated that no more than two trucks and drivers would be needed to ferry materials to the end of the road. One individual would be needed to unload materials on the road, while another would be loading materials at the staging area. On the river, the staging area could best be accommodated by barge (Maxwell, 1983, personal communication). Based on nationwide estimated medians for 1983 (U.S. Department of Labor, 1983) the potential weekly earnings associated with construction occupations excluding supervisors that could be required to build a trestle road would average about $360.

4.205 Materials needed for a 12- to 15-foot-wide trestle road would vary depending on the weight that had to be supported and the elevation of the road. In the worst case, the structure would probably require steel beams or prestressed concrete on steel or concrete piles; however, the deck area could be heavy timber. The method of construction would be to build from the top one bent at a time (Maxwell, 1983, personal communication). At a maximum, 8 timber piles to a bent could be required. The spacing of the bents would at most be about 10 feet (Maxwell, 1983, personal communication). The lighter the weight to support, the greater the spacing of bents.

4.206 Several employment positions could be filled from the local labor pool, particularly at the staging area where no special skills would be required. The bolting crew, crane operator and supervisor would mostly consist of the contractor's employees. Depending on the location of the contracting firm these individuals may or may not reside in the local area. Assuming all of the individuals involved in the road and platform construction were from the local area, employment would be provided for an estimated 20 to 25 people. If a firm in a neighboring state were to receive the bid some temporary inmigration could be expected.

4.207 The clearing operation would progress one bent at a time. Clearing crews on the ground would saw the vegetation, while removing stumps would be from the top of the road. Depending on the species and age of the trees this aspect of construction could be the most time consuming phase (Maxwell, 1983, personal communication).

4.208 Navigation. With the exception of one trip by a barge-mounted dredge and one or two extra barge trips delivering

trestle road materials the additional waterway traffic for this alternative would be generally the same as that for a platform with canal access. The major difference for this alternative is that all waterway traffic would be moored on the bank of the channel or at a barge used as a staging area while off-loading personnel and supplies. A moored barge with a crane would probably be used for transferring material from incoming barges to the work area.

Routine Operations

4.209 Once construction was completed and the drilling rig assembled, drilling of the well would commence.

4.210 Water Quality. If access to the trestle road is from a navigable channel, impacts to surface water quality during routine operation would be due to boat traffic (as described previously) and due to runoff of grease and oil from the trestle road to the adjacent wetland and river channel. If the crew of a rig would commute each day, then the greater number of daily trips by crew boats would result in more emissions of engine wastes and possibly accelerate bank erosion along the river channel (depending upon soil erodability).

4.211 Hydrology. The support piles of the platform and trestle road would cause obstruction to flood waters of the Delta, but because of the height of the road and space between pile clusters, the hydrological impact should be localized.

4.212 Wetland Ecosystems. The biological productivity of the area under the platform and trestle road would be greatly reduced or eliminated for the duration of drilling at the site. The effect of this has been discussed for the canal and platform alternative.

4.213 Aquatic Ecosystems. Aquatic ecosystems in the vicinity of the mooring area could possibly be affected slightly by turbidity resulting from propwash of vessels.

4.214 Wastewater Disposal. Treatment and disposal of wastewater would involve the same procedures as discussed previously for site preparation. The no-discharge rule would apply for delta well sites.

4.215 Groundwater. The potential groundwater effects associated with the routine operations of a drilling platform with trestle road access would be the same as those discussed for routine operations of a canal and slip system.

4.216 Air Emissions. Air emissions associated with these activities are shown in Table 4-3.

4.217 Noise. Normal activities would involve drilling and rig maintenance, and would be similar to noise levels of the drilling platform with canal access alternative. Traffic, however, would include auto/truck in addition to watercraft.

4.218 Solid and Hazardous Wastes. Routine operations would result in the same constituents and quantities of solid waste described under the canal and slip alternative. If the rig were operated as a conventional land rig there would be little of the wastes associated with live-on crews.

4.219 Socioeconomic Characteristics. Personnel requirements and related activities for a land-like operation are described under the alternative of a fixed platform with canal access.

4.220 Navigation. The additional waterway traffic from routine operations of a fixed platform with trestle road access would generally be the same as that for the canal and slip baseline alternative with the exception that the operation of the fixed platform as a land drilling operation would require additional crew boat trips for the three daily shift changes. Under this alternative, crew boats could average 9 or 10 round trips a day between the site and a local boat landing. In the same fashion as site preparation activities, all waterway traffic would probably use a permanently moored barge as a landing platform in delivering supplies and personnel and hauling out wastes from the site. The permanent mooring of a barge in the waterway could add a potential hazard to area navigation. However, the major commercial navigation route in the Delta, the Mobile River, is several hundred feet wide while a moored barge has a width of about 45 feet and with a second barge moored along side for transferring material would project into the waterway less than 100 feet. In the Mobile River, the federal navigations channel is 200 feet wide and no structure or permanently moored barge would be permitted to impinge on this channel. Although other waterways in the Delta are not as wide as the Mobile River, the traffic on these channels would consist of occasional small craft. In neither case should the moored barge and the traffic connected with it be a significant hazard in most channels in the Delta.

Fixed Platform on River Bank

4.221 Directional drilling from a fixed platform on the bank of a natural channel could be used to reach a geological target located beneath adjacent wetland areas. A possible site plan is

given in Figure 4-6. This drilling method would reduce the wetland area altered by eliminating the need for an access canal or trestle road to reach a drilling platform located directly over the geological target. The maximum lateral distance of the bottom location of the well from the surface drilling site that can be achieved with current drilling technology is about one mile at the 17,000 to 18,000 foot depth of the deepest formations of interest in the Delta. Another method of drilling site access would have to be used where a river bank location was not feasible.

4.222 The rig would be operated as a typical land site as described for the drilling platform with canal access alternative. Material and personnel would be brought to and from the location by boat and barge. Mooring structures would probably be required in the river channel next to the platform.

4.222a Emplacement of a fixed platform on the river bank may not require a permit from the U.S. Army Corps of Engineers if no dredging or placement of dredged or fill material is required and if no structures are placed in navigable waters.

Site Preparation

4.223 Site preparation would consist of clearing the area of trees and constructing the platform and associated mooring structures.

4.224 Water Quality. Turbidity would be increased during the pile driving and due to construction activities during the placement and assembling of the drilling platform. Creosote residue in water surrounding piles may be present for four to five days. Concentration of engine exhaust products would increase due to boat traffic. These impacts would be similar to those described previously.

4.225 Hydrology. Effects on hydrology due to site preparation would be limited to eddies within a few hundred feet downstream of the drilling platform. Effects would be the same type as those discussed previously for an inland drilling barge located at a river bank.

4.226 Wetland Ecosystems. Wetland area disturbed by site preparation would be the same as for other fixed platform alternatives: approximately 100 feet by 200 feet with 20 by 100 foot docking areas on either side of the platform or about 1/2 acre disturbed. Effects on the wetland ecosystem would result from the removal of larger woody vegetation and trees from the area of the drilling platform and from surface disturbance if construction machinery is operated directly on the cleared land. These effects have been discussed for the drilling platform and canal alternative.

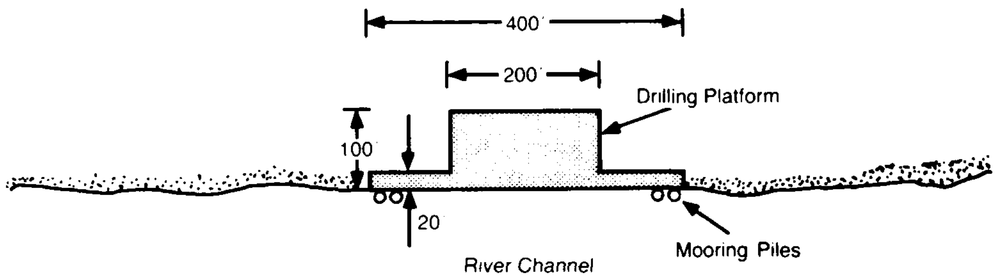

FIGURE 4-6
POSSIBLE SITE PLAN FOR USE OF A FIXED DRILLING PLATFORM AT A RIVER BANK LOCATION IN THE MOBILE DELTA

4.227 Aquatic Ecosystems. Aquatic ecosystems would be affected only slightly by temporary turbidity resulting from the driving of piles during the construction of mooring facilities in the navigable channel and by propwash of vessels in the vicinity of the mooring facility.

4.228 Wastewater Disposal. Treatment and disposal of wastewater would involve the same procedures as discussed previously for the canal and slip drilling alternative. The no-discharge rule would apply for delta well sites.

4.229 Groundwater. Potential groundwater effects would be basically the same as described for the canal and slip alternative: altered circulation and drainage and potential alterations to groundwater quality in the uppermost portions of the alluvial aquifer. However, the elimination of wetland dredging would minimize any potential effects to groundwater resources from dredging.

4.230 Air Emissions. Air emissions associated with this alternative are shown in Table 4-3.

4.231 Noise. Site preparation would require clearing and grading of the river bank. Site preparation and construction of an access road would involve activities and noise levels similar to those listed in Appendix E. River access may require some maintenance dredging which may be comparable to 85 dBA at 100 feet (U.S. Environmental Protection Agency, Region IV, 1978).

4.232 Solid and Hazardous Waste. Solid waste would be limited to a small volume of trash and construction debris. Barge-mounted cranes and other equipment limits the need for land-based access.

4.233 Socioeconomic Characteristics. The construction requirements and associated effects from erecting a platform were described under the alternative of using a fixed platform with canal access. The difference with this alternative is that neither a trestle road nor canal would be required. The effects from these alternatives are presented under previous alternatives.

4.234 Navigation. The only difference in waterway traffic for this alternative and the fixed platform with trestle road access alternative is that there would be no barges delivering trestle road construction materials. In all other aspects of waterway traffic this alternative is the same.

Routine Operations

4.235 The effects of routine operation of a drilling platform at a river bank location would be almost identical to the operation of a drilling platform and trestle road system. The main difference would be that less wetland area would be altered because area would be required only for a platform. Spills would be difficult to contain with this operating method, especially during high water.

Board Road and Ring Levee

4.236 It is possible that drilling on some portions of the Delta could be accomplished by using a land rig with a board road and ring levee system. Areas where this method might be suitable would be the areas immediately adjacent to uplands and in the extreme northern portion of the Delta where wetland surface elevations might be high enough so that seasonal flood heights could be handled by a ring levee system. A board road and ring levee system was used for drilling the South Carlton field on the Alabama River 10 miles northeast of the junction with the Tombigbee River. Well site elevations at that location are between 10 and 15 feet above sea level.

4.237 A typical plan for a board road is shown in Figure 4-7. A typical ring levee system is shown in Figure 4-8.

Site Preparation

4.238 Site preparation consists of construction of the board road and ring levee and preparation of the boarded drilling area. Typically, a dragline would be used to remove material from borrow ditches to build up the road. Layers of boards are placed on the fill as the road surface. A levee is constructed around the drilling area with material from a single borrow ditch. The height of the levee and road fill would depend on the height of flooding that could occur at the site. A large area is left within the levee so that the drilling site can be moved if necessary. Layers of boards are placed at the drilling site to support the rig and other heavy equipment. Because the water level within the levee may rise with flooding outside the levee, the drilling location and support area may also have to be elevated on fill material.

4.239 Water Quality. Surface water quality impacts during site preparation would be similar to those described previously for a trestle road. For a river access to the board road, the potential for increased turbidity during construction is greater for the board road than the trestle road due to the excavating of spoil for both the levee and the well site and due to creation of a channel which

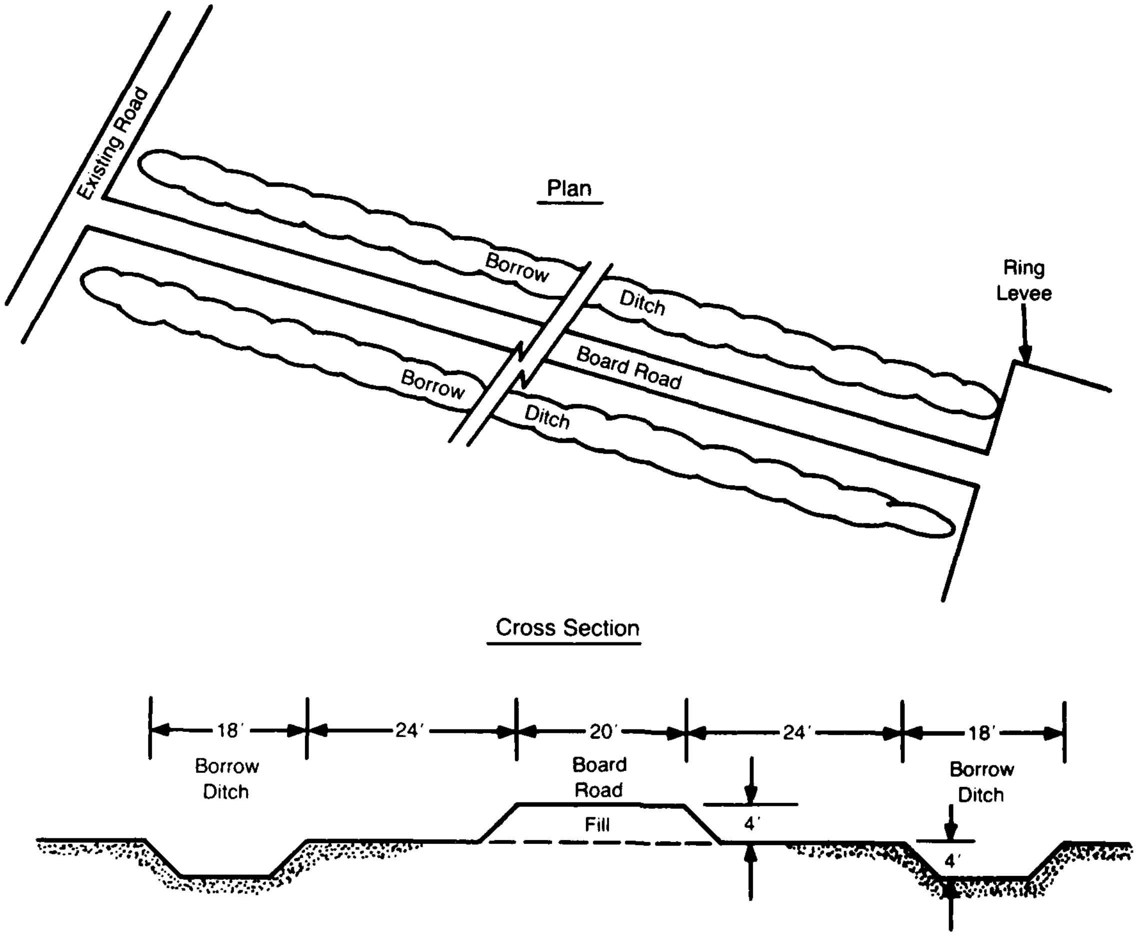

FIGURE 4-7
PLAN AND CROSS SECTION OF A TYPICAL BOARD ROAD CONSTRUCTED ON FILL IN THE MOBILE DELTA

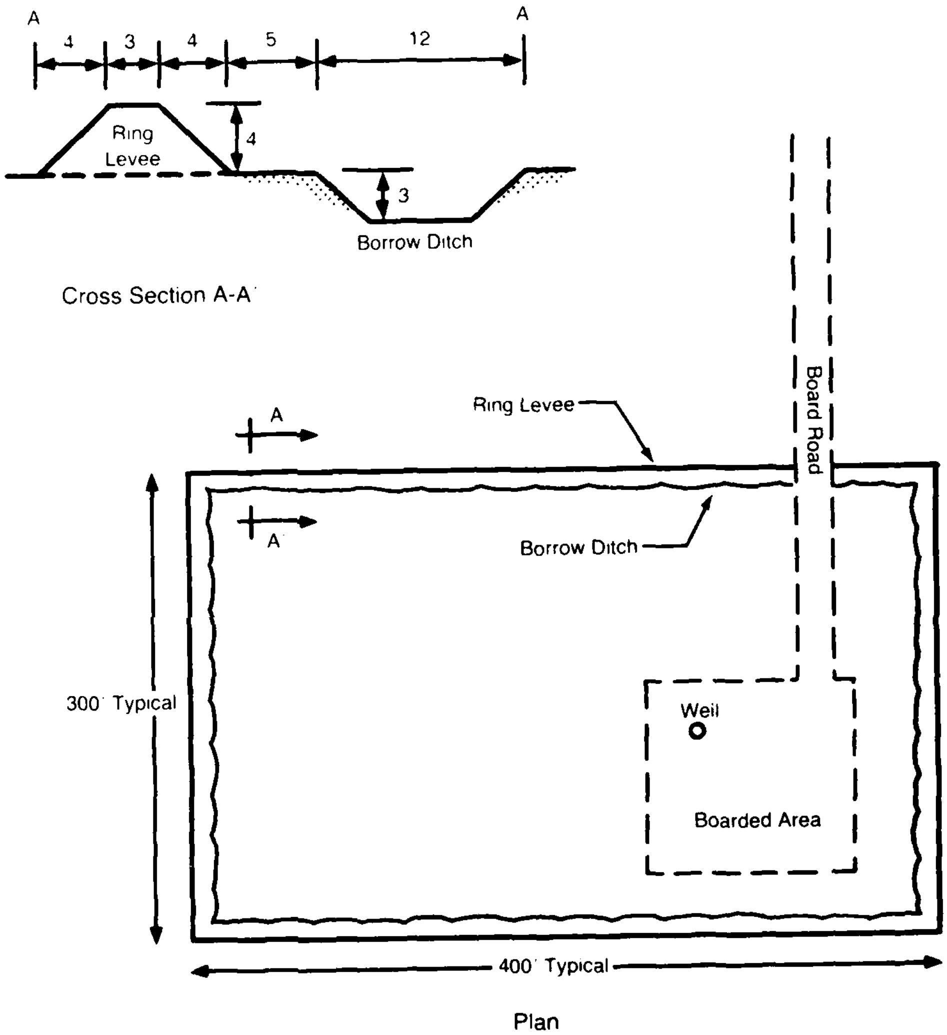

FIGURE 4-8
POSSIBLE PLAN AND CROSS SECTION OF A RING LEVEE SYSTEM IN THE MOBILE DELTA

would direct runoff toward the rivers. Impacts due to erosion are usually minor (Longley, et al., 1981).

4.240 Hydrology. Water would be able to move more freely along the board road and within the borrow ditches parallel to the board road, if flow inhibitors such as plugs within the borrow ditches are not implemented. Without flow inhibitors, interior wetlands adjacent to the board road and well site would tend to drain more easily than if this site access alternative is not implemented.

4.241 Wetland Ecosystems. Wetland areas would be disturbed by placement of boards for the board road and for the boarded drill pad. Additional disturbance could occur if the road and pad needed to be placed on fill dredged from an adjacent borrow ditch and if the drill pad needed to be protected by a ring levee dredged from its borrow ditch. For a board road and boarded drilling pad established at or near grade, the wetland area disturbed by vegetation clearing and emplacement of the boards would be about 1/2 acre per 1000 feet of board road and 1/4 acre or 1/2 acre for a 100-foot square or 150-foot square drilling pad.

4.242 However, if the board road needs to be constructed on fill dredged from adjacent borrow ditches and if the boarded drill pad needs to be protected by a ring levee, the area disturbed would increase significantly. A board road on fill would disturb almost 2 1/2 acres per 1000 feet of road, nearly 1 acre of which would be borrow ditches filled with standing water. A ring levee and its adjacent borrow ditch would disturb approximately 2/3 acre per 1000 feet of ring levee, if the construction is as shown in Figure 4-8. The area disturbed would increase as the height of the required levee increased.

4.243 Groundwater. Potential groundwater effects would be basically the same as described for the canal and slip alternative: altered circulation and drainage and potential alterations to groundwater quality in the uppermost portions of the alluvial aquifer.

4.244 Air Emissions. Air emissions associated with this alternative are shown in Table 4-3.

4.245 Noise. Construction of a ring levee and possibly the board road would involve transport of spoil (fill). This could be accomplished through the construction of a board road accessing a main road. Board road construction in terms of noise would require industrial trucks and other vehicles, generators, basic construction tools such as saws, and land clearing as necessary (Appendix E).

4.246 Construction of the ring levee would necessitate dike construction and dredge and fill operations, which would require bulldozer and dragline equipment. Additional shell and/or gravel fill could be imported by truck via the board road to support the actual land rig within the ring levee. Foundation construction for land rigs may also be required, depending on local soil characteristics. This would involve the use of piles and pile drivers as well as construction of concrete mats. In terms of noise, bulldozers, draglines (noise levels probably similar to bulldozers), trucks, pile drivers, and supportive construction equipment would be utilized.

4.247 Rigging-up for land drilling rigs would involve cranes or hoists and various construction tools. A water well may be drilled for drilling mud purposes unless water or pre-mixed mud is delivered on location. Water well drilling noise would be less than oil and gas well drilling due to the relatively smaller rig needed. Noise levels associated with these activities are shown in Appendix E.

4.248 Solid and Hazardous Wastes. The solid waste generated by this alternative would be similar in type and quantity to that generated by the inland barge canal and slip location. The possibility of biomass being trucked offsite exist with this alternative.

4.249 Socioeconomic Characteristics. An unelevated board road without a ring levee would typically require one to five bulldozers to prepare the right-of-way. An elevated road and ring levee would require the use of dredging equipment. An average crew has about 15 workers; however, in the most difficult territory as many as 30 may be needed. If a large non-local firm secures the contract, about half the crew would be company employees, while the rest could be local (Bergeron, 1983, personal communication). Generally, about 15 to 20 days are needed to clear an area, build it up and lay down the boards; some projects could take a month (Bergeron, 1983, personal communication).

4.250 The primary skills required for board road and ring levee construction is heavy equipment operation. In 1983 the weekly national average wage for bulldozer operators was about $310 (U.S. Department of Labor, 1983). Unskilled laborers make up the bulk of a crew (averaging about $270 per week); these could be readily obtained from the local area.

4.251 Although board road construction would have little if any effect on housing or community services, it does create employment for a number of unskilled workers. Existing land use of

a board road right-of-way could be affected, and traffic on area roads could be expected to increase during construction and operation of the well.

Routine Operations

4.252 During routine drilling operations, the board road and ring levee would remain in place.

4.253 Water Quality. If the marsh is above sea level and the tidal influence is low, borrow pits may cause abnormal draining of the marsh surface and upper soil layers. If the marsh is near sea level with a moderate tidal fluctuation, the borrow pit may cause water to intrude further into the marsh than normal. The amount of draining or intrusion is site specific (Longley, et al., 1981).

4.254 Raney and Youngblood (1982) used a two-dimensional depth averaged finite difference model to study the hydrological effects on Bayou Sara of the Louisville and Nashville Railroad, which crosses the Mobile River Delta, during flood events. The railroad is built on fill with several relief openings, which is similar to a board road. Results of the model run indicate that, with or without the railroad, flow passes along the existing channels. A great deal of water is stored on the floodplain, but there is not a large quantity of flow along or across the floodplains. Within the interior of the Mobile River Delta, in some locations a 1.5 foot difference in flood stage elevation across the railroad was calculated for a 500 year flood, and a difference of 0.8 feet was calculated for a 2 year flood. The study concluded that the railroad does affect flow patterns in the Mobile River Delta, but the effect is small compared with the overall flood condition for Bayou Sara. For economic reasons it is unlikely that an oil company would build a road across the entire width of the Mobile River Delta. Therefore, the railroad can be considered as a conservative worst case condition. If relief openings are not constructed through a board road at the areas of low elevation, the blockage may cause ponds or lakes to form. Impacts to surface water quality for river access to the board road would be the same as those listed for a trestle road.

4.255 Hydrology. Spoil piles adjacent to the borrow ditches could alter flood flow paths along the delta wetland, if the piles are continuous. In addition, flood flows may not be able to cross under the board road unless culverts beneath the board road are provided at periodic distances along the road.

4.256 Wetland Ecosystems. Wetland area disturbed during preparation of the site would remain disturbed for the duration of drilling at the site.

4.257 Wastewater Disposal. Treatment and disposal of wastewater would involve the same procedures as discussed previously for the canal and slip alternative, with the exception of the ability to utilize land transportation. The no-discharge rule would apply for delta well sites. Wastewater from well sites could be transported via tank trucks or a temporary pipeline parallel to the board road to a tank truck at an upland site.

4.258 Groundwater. The potential groundwater effects associated with the routine operations of a board road and ring levee system would be the same as those discussed for routine operations of a canal and slip system.

4.259 Air Emissions. Air emissions associated with these activities are shown in Table 4-3.

4.260 Noise. Normal activities would include drilling, rig maintenance, and truck/auto traffic. Noise production would be similar to rig operations on a platform previously described. Traffic, however, would be noisier than for normal paved highways due to the board pad surface.

4.261 Solid and Hazardous Wastes. Under the alternative of using a conventional land rig with a board road and ring levee, solid waste would be the same as described for the canal and slip location with less domestic waste due to the reduced live-on crew.

4.262 Socioeconomic Characteristics. A land rig at the end of a board road would be operated like any land operation as described under the alternative "Fixed Platform with Canal Access" (and in Chapter 7). The difference with this alternative is that crew changes and supply deliveries would not be made by river transport. Rather, crew shifts and deliveries would be made by car and truck at the rig site resulting in a minor increase of traffic.

Cultural Resources

4.263 The cultural resources of the area, whether historical or archaeological sites, may be affected by a project in a variety of ways. Historical sites may be affected by alteration and destruction of a property, isolation from or alteration of its surrounding environment, or the introduction of visible or audible elements that are out of character with the property. Archaeological sites, and historical sites that would be investigated using

archaeological techniques, are more easily disturbed. Basically, any activity that produces surface disturbances has the potential for impacting an archaeological site.

4.264 For oil and gas exploration in the Delta, one or more levels of cultural resources investigations may be required. Initially, a review of available literature on the area and a search of records of previous surveys in the area and site files is undertaken to determine whether properties listed on or potentially eligible for the National Register of Historic Places are known to exist in the vicinity of the project. Dependent on the findings of this initial review, additional field reconnaissances or surveys may be required. The views of the appropriate State Preservation Officer, National Park Service and other knowledgeable individuals are considered in determining the need for these field surveys.

Commercial Fisheries

4.265 In the Delta, commercial fishing is a relatively small industry with an estimated 240 commercial fisherman, 70 percent of whom are part time (Malvestuto et al., 1983). The greatest number of daily boat trips occur on the weekend with an average high of 65 boat trips per day. Commercial fishing is not concentrated in a single area of the Delta and because of the relatively small number of daily boat trips and the number and geographic spread of access points (public and private launching ramps), it is not likely that waterway traffic associated with a particular oil or gas drilling project would affect the commercial fishing activities.

Transport and Fate of Crude Oil Spills

4.266 If loss of well control occurs during drilling, crude oil and/or natural gas containing hydrogen sulfide could be released to the Mobile Delta. Characteristics of oil likely to be found in the Delta are unknown but some reasonable assumptions can be made. Oil in the Movico Field in the northern Delta and the Hatter's Pond Field just to the west of the Delta have characteristics as shown in Table 4-8. It is likely that oil found in the Delta would be a very light crude with low molecular weight compounds accounting for a large fraction of the total liquids. With loss of well control the condensate fraction would also condense out at the release point.

4.266a Probabilities of accidents occurring can vary depending upon engineering, installation and operation-maintenance procedures. Based on current technology, the probability of a well blowout is estimated to be one for 250 wells, and the probability of a pipeline rupture is estimated to be 0.00138 incidents per year per mile of pipeline. Both well blowouts and pipeline ruptures could

TABLE 4-8

RESERVOIR FLUID COMPOSITION OF THE MOVICO AND HATTER'S POND FIELDS, MOBILE COUNTY, ALABAMA

Fluid Component	Field	
	Movico[a,c] (mole percent)	Hatter's Pond[b,c] (mole percent)
Hydrogen sulfide	trace	0.55
Carbon dioxide	0.87	3.71
Nitrogen	3.53	3.98
Methane	40.72	46.08
Ethane	9.53	9.60
Propane	5.81	6.65
Iso-butane	1.80	2.47
N-Butane	3.21	4.07
Iso-pentane	1.80	2.24
Hexanes	2.58	3.46
Heptanes plus	28.44	14.94
TOTAL	100.0	100.00

[a] Annie M. Hill et al., Unit 39, No. 3

[b] Typical values for field

[c] Full well stream

Source: Superior Oil, 1982a.

spill a wide range of hydrocarbon quantities depending upon the reason for the accident and the quickness with which the spill is controlled.

4.267 Crude oil spreads more than refined gasoline and other more evaporable or soluble materials. A spill larger than 0.2 ton or 56 gallons in a standard 65-foot wide well access canal would reach the sides of the canal. Based on the assumption that a typical canal is 1,000 feet long, a spill larger than 0.5 ton or 140 gallons at the end of a canal could extend into the adjoining river channel without wind or water current effects. Spills of one ton or more in a river channel would reach channel banks where ever the river channel is less than 380 feet in width (assuming the spill occures at mid-width).

4.268 A very light crude such as might be spilled in the Delta would have a large proportion of the mass as volatile compounds. Evaporation of this fraction would be rapid. A light crude could lose 50 percent or more of the spilled mass through evaporation in 10 days (U.S. Department of the Interior, 1982a). This mechanism is very temperature dependent, however (Gearing and Gearing, 1982). The higher the temperature the faster the evaporation rate (as defined in Section 5.2.6.1 of Appendix G).

4.269 A Louisiana crude oil spill of one ton or more (as defined in Section 5.2.6.1 of Appendix G) is estimated to travel 1,000 feet along a canal from a rig or platform to the river channel in less than 30 minutes. Hence, measures to minimize impacts on the river channel would need to be quickly instituted if a crude oil spill occurs. For shorter canals or with wind or swifter water currents, measures would need to be instituted even more quickly.

4.270 Within a river channel, such as the Mobile or Tensaw River, spilled oil would spread on the water surface even in the absence of wind or water currents. Distances which spilled oil would move in the absence of wind or water current can vary depending primarily upon the quantity of oil spilled and the width of the river channel. Table 4-9 presents estimated lengths of river channel that could be affected by a spill due solely to inertia, viscosity, surface tension, and density differences between the spilled oil and the water in the river channel. For a small spill of less than 0.2 to 0.3 tons, less than 100 feet of river channel length would be affected without wind or water currents, however, for large spills exceeding 1,000 tons over 18 miles of river channel length could be affected.

4.270a Because greater water velocities are generally evident in a river channel than in a canal or slip, control of a spill is

TABLE 4-9

MAXIMUM LENGTH OF RIVER CHANNEL (IN FEET) WITH ENTIRE WIDTH AFFECTED BY A SPILL OF LOUISIANA CRUDE OIL WITHOUT WIND AND WATER CURRENT

Quantity of Crude Oil Spilled, in Tons	250-Foot Wide Channel	500-Foot Wide Channel	1,000-Foot Wide Channel	2,000-Foot Wide Channel
0.1	60	60	60	60
0.2	85	85	85	85
0.5	250	140	140	140
1.0	450	190	190	190
10.0	4,500	2,300	1,100	600
100.0	45,000	23,000	11,000	5,700
1,000.0	100,000+	100,000+	100,000+	58,000
5,000.0	100,000+	100,000+	100,000+	100,000+

Assumptions: Temperature of oil and receiving water is 20 degrees Centigrade. No wind or water currents are evident except for time of arrival estimates 1,000 feet downstream of a spill. Differences in oil movement on fresh water and saline water are negligible.

Notes: Louisiana crude oil is the type of crude oil expected to be extracted within the project area; its density is approximately 0.85 gram per cubic centimeter (water has a density of 1.0 gram per cubic centimeter). One ton of Louisiana crude oil is equal to 6.7 barrels (280 gallons).

Source of Methodology: U.S. Department of Transportation, 1977.

more difficult in a river channel. Response of a clean-up crew would need to be more rapid in order to control spill movement if a spill occurs in a river channel.

4.271 Clearly, the lengths of river channel affected by a spill in the presence of wind and water currents vary with the time a spill is allowed to travel. Table 4-10 provides estimates of distances along a river channel which a spill can travel for various travel times. Within the accuracy of estimates presented in Table 4-10, variations in the quantities of spilled crude oil do not alter oil travel distances, because the time frames given in Table 4-10 are relatively short and effects of wind and currents overshadow effects assessed in Table 4-9. The average case is based on an average flow of water through the delta (64,000 cubic feet per second); velocities vary from 0.6 to 0.9 feet per second for the four river channels at the mouth of the delta. The worst case is based on a 40-mile-per-hour wind and a maximum flow of water (250,000 cubic feet per second) above which water from the river channel would overflow banks of the river channel. Even under the average case, a spill can travel 11 to 16 miles in 24 hours, while under the worst case a spill could travel the entire length of the Mobile or Tensaw Rivers and into Mobile Bay in less than 24 hours. Effects of river banks on movement of spilled oil are not included in the estimates shown in Table 4-10. The persistance of worst-case conditions continuously for more than a few hours at a time is considered remote.

4.272 Water velocities at the mouths of the four river channels, based on average flows and cross-sectional areas, are 0.6 feet per second for the Mobile and Tensaw Rivers, 0.8 feet per second for the Apalachee River and 0.9 feet per second for the Blakely River. A spill could exit the Apalachee River to Mobile Bay in 5.5 hours or less and the Blakely River in 6.5 hours or less under average conditions and depending upon the precise location of the spill. Within the Mobile and Tensaw Rivers, spill travel times before reaching Mobile Bay depend upon where the spill occurs. A spill 10 river miles from Mobile Bay, for example, could reach the Bay in approximately 24 hours under average conditions, while a spill 20 river miles from the Bay would take approximately 49 hours to reach the Bay under average conditions in either the Mobile or Tensaw Rivers.

4.273 Flood water movements over the delta wetlands would, unlike flows in river channels, not distinctly move from north to south (i.e., upstream to downstream). Flood waters could move in a variety of directions, although the general tendency would be for flood waters to move southward toward Mobile Bay. Flood water velocities also may not be as high over wetlands as are velocities

TABLE 4-10

DISTANCES SPILLS OF LOUISIANA CRUDE OIL CAN TRAVERSE AT OR NEAR THE WATER SURFACE (IN FEET) FOR VARIOUS TIMES OF TRAVEL (T_T) IN THE MOBILE RIVER-DELTA

Time of Travel	No Current or Wind[1]	Average Case[2]	Worst Case[3]
30 minutes	240 ft.	1,300-1,900 ft.	8,100-10,000 ft.
4 hours	1,100 ft.	9,700-14,000 ft. (1.8-2.7 miles)	64,000-81,000 ft. (12-15 miles)
13 hours	2,600 ft.	31,000-45,000 ft. (5.8-8.5 miles)	110,000-170,000 ft. (21-32 miles)
24 hours	4,200 ft.	56,000-82,000 ft. (11-16 miles)	380,000-480,000 ft. (72-92 miles)

[1] Includes effects of inertia, and effects of density, viscosity and surface tension differences between the water and the spilled oil, but shoreline effects are neglected.

[2] Based on a current at the water surface of 0.6 to 0.9 feet per second (based on flow data and geometry of river mouths, verified by Chermock, 1974) plus the travel distances in the absence of current or wind.

[3] Based on a current at the water surface of 2.3 to 3.5 feet per second, a 40-mile per hour wind in the same direction as the current, plus the travel distances in the absence of current or wind.

Source for some numbers: U.S. Department of Transportation, 1977.

of water in the river channels. Hence speeds, directions, and times of travel for spill movements during floods are not quantifiable without flood water velocity data. Spilled materials may adhere to trees and other types of wetland vegetation. The high concentration of suspended solids at high water would enhance the rate of scavenging of the unsoluble fraction of the spill from the water column.

4.274 The relatively insoluble hydrocarbon fractions (saturates) would be rapidly sorbed to the abundant suspended particulate matter in the water column of most channels in the Delta and removed from the water column as this material settled to the bottom (Olsen et al., 1982; Elmgren and Frithsen, 1982; Gearing and Gearing, 1982; Gearing et al., 1980; Wade and Quinn, 1980). Once in the sediments, this oil could persist for several years depending on the sediment dynamics of the particular channel (Olsen et al., 1982).

4.275 Water velocities within bays of the southern Delta are random in direction and quite sluggish. Most of the water from the Alabama and Tombigbee River Basins travels through the delta via the river channels bypassing the small bays. A release of 1 ton or less of refined gasoline, methane or hydrogen sulfide would spread to a maximum radius of 110, 30 and 25 feet respectively. Such a spill of gasoline would evaporate in less than 10 minutes, while a release of methane or hydrogen sulfide would evaporate in less than 1 minute. A spill of Louisiana crude oil could spread, in the absence of shoreline as follows depending upon the quantity of oil spilled (U.S. Department of Transportation, 1977 for estimating methodology):

Quantity Spilled, Tons	Maximum Pool Radius, Feet
0.1	60
0.2	85
0.5	140
1.0	190
10.	600
100.	1900
1000.	6100

Ecological Effects of Spills and Loss of Well Control

4.276 If loss of well control occurs during drilling, crude oil and/or natural gas could be released to the Mobile Delta. In addition, substances are used on the drilling rig or support vessels that, if spilled, could have adverse effects on the aquatic and wetland environments. Materials of concern include the following:

- o Crude oil
- o Fuel, lubricants and hydraulic fluids
- o Drilling fluids
- o Chemicals
- o Natural gas containing hydrogen sulfide

4.277 The effect of a spill in the Delta would depend on several factors. Some of these are as follows:

- o Volume spilled
- o Type of material spilled
- o Location of spill
- o Drilling alternative being used (which would affect the ability to control a spill)
- o River stage
- o Time of year
- o Rapidity and effectiveness of cleanup efforts

Crude Oil

4.278 The effects that result from a crude oil spill in the Delta would depend on the conditions at the time of the spill and the location of the spill. For example, a spill occurring in the slip at the end of a canal would be easier to contain than a spill in the river channel because of the surrounding dikes and the containment boom placed across the access canal. River stage could also be an important factor. At low water, a spill would tend to be confined to the waterway channel. At high water, oil would be also transported onto the forested floodplain wetland. Considered below are three large uncontrolled spill cases of interest in the Delta:

- o Spill at low water
- o Spill at high water
- o Spill in the bays of the southern Delta

4.279 Spill at Low-Water. During low water stages in the Delta, an uncontained spill of crude oil would be distributed mostly

within the natural flow channels. Current flow would be the main factor responsible for transport of the spill.

4.280 Dissolution of the low molecular weight aromatic fractions, many of which are acutely toxic, into the water column would probably be rapid because of the turbulent flow in the channel. While such mixing would also serve to dilute these soluble hydrocarbons, it would be likely that acute toxicity to near-downstream benthic and water column organisms would result if the spill was large enough and dilution by mixing was slow enough. Direct contact of the surface slick with the bank would also cause acute toxicity to organisms in that narrow zone.

4.281 Once the oil input ceased, material in the water column would be rapidly diluted downstream, lost to the atmosphere by evaporation, sorbed to particulate matter or biodegraded by bacteria. Direct water column effects would be short-term, lasting only while the spill continued or for a short period afterwards.

4.282 Relatively insoluble hydrocarbon fractions would be carried to the sediments (see transport and fate section above). The effect of oil remaining in the sediments could last much longer depending on the sediment concentrations achieved and persistance of the oil. Mixing of the oil deeper into the sediments would occur from bioturbation by benthic organisms. If oil concentrations are great enough, benthic organisms could die and the growth of benthic communities could be reduced (Olsen et al., 1982; MacDonald and Thomas, 1982; Grassle et al., 1981; Oviatt et al., 1982). Deposit feeding benthic organisms could accumulate hydrocarbons in their tissues. Some increase in hydrocarbon concentrations in tissue of fish in the affected area could occur.

4.283 Recovery of areas that experienced acute toxicity could be slow. Oil in sediments would slowly be eliminated by biodegradation by bacteria, bedload transport of sediments and burial in areas of accretion such as point bars. Oil on the river bank may oxidize more rapidly than oil in the sediments. Waterfowl and other aquatic birds would be affected to the extent that they come in contact with the surface slick. Mortality is high among birds coated with oil. Oiling of eggs from oil carried to the nest by the adult can also reduce the hatching rate. Residual oil could also reduce or eliminate the area available for spawning and feeding of aquatic organisms.

4.284 Spill at High Water. A large uncontrolled spill during a high water river stage could be distributed widely over the

forested floodplain as well as within the natural river channel. The same transport and fate processes would occur at high water as at low water.

4.285 Acute toxicity would occur in the immediate vicinity of the spill to both plants and animals. Fish eggs, larvae and juveniles on the floodplain during the spawning season could be killed. High mortality from oiling of waterfowl feeding on the floodplain could also occur.

4.286 Deposition of suspended sediment with sorbed oil would occur on the floodplain, especially on the levee areas adjacent to the river channel. Oil deposited on the floodplain would probably be very persistant in such a low energy environment.

4.287 The ecological effects of oil remaining on the floodplain could vary depending on the elevation. Oil could be less persistant on the higher elevation levees than on lower elevation soils that may remain permanently saturated. In heavily oiled areas, faunal recovery may be very slow. Where acutely toxic concentrations were not reached, biomass, diversity and growth rates of macroinvertebrates and small vertebrates may be reduced and sublethal effects occur for an extended period. Spawning success of fish may be reduced in oiled areas and the habitat value for waterfowl reduced.

4.288 Spills in the Bays of the Southern Delta. A spill of crude oil in the bays and emergent vegetation areas of the treeless southern portion of the Delta could have extensive ecological consequences depending on the time of year. Mortality of both emergent and submersed vegetation and aquatic organisms would occur. Larval and juvenile forms of many estuarine animals could be killed. If the spill occurred during waterfowl migration or overwintering, considerable mortality could result. Persistence of oil in sediments could reduce the productivity of the bays, degrade the habitat and reduce its value as waterfowl habitat and as nursery area for many organisms for several years.

Fuel Oil

4.289 Fuel oil would be used on the drilling rig and in support vessels. Spills could occur during refueling, from accidents on the drilling rig and as a result of a marine accident during transport of fuel to the drilling site. Drilling rigs would be refueled every 2 to 4 weeks depending on on-board storage capacity. Typical rig storage capacity would be 75,000 to 100,000 gallons. Fuel transport barges generally contain about 40,000 gallons.

4.290 Fuel oil has been found to be more toxic than many crude oils because the greater proportion of toxic lower molecular weight hydrocarbons in fuel oil. However, the very light crude likely to be found in the Delta could be similar in many ways to the toxicity of fuel oil. Therefore, the effects of a fuel oil spill in the Delta would be similar to those described above for a crude oil spill. As with crude oil, any fuel oil reaching the sediments (especially flood plain sediments and the southern Delta) could persist for many years.

Drilling Fluids

4.291 Spills and accidents at a drilling rig can occur at any phase of drilling activities from exploration through abandonment. The most common spills occur during loading and unloading activities from service vessels, leaks, or accidental discharges overboard. Such incidents normally result in relatively small discharges of any of the raw materials required or waste products produced during drilling operations. Major accidents on the other hand, such as a drill rig fire or capsizing, could result in the discharge of the entire contents of the drill rig into the marine environment as well as a discharge of gas or oil.

4.292 Materials which could be discharged into the delta environment in addition to oil include bentonite, cement, polymer, drill mud additives, diesel fuel, drill cuttings, drill mud, produced water, garbage, and chemicals.

4.293 Drilling fluids may contain bentonite, barium sulfate, ferrochrome lignosulfate, carboxymethylcellulose, and caustic soda (Menzie, 1982). These components represent the bulk of drilling fluid additives, with barite the major component. A second group of components used primarily for special circumstances includes surfactants, defoaming agents, lubricants, bactericides, and hydrogen sulfide and oxygen scavenging agents. Petrazzuolo (1981) reported that amounts of these secondary components used were highly variable, normally less than 50 tons. Discharges of these components in the drill fluids could affect toxicity and heavy metal concentrations.

4.293a Recent unpermitted discharges or spills of drilling muds have been documented in the Mobile River Delta. In March of 1983, ADEM inspectors took sediment samples in the Superior Oil Company drilling barge canal slip (Lease Section 39). Analysis of these samples showed elevated levels of barium sulfate, a major component of drilling muds. The contaminants entered waters of the State on several instances and by different actions during Superior's

hydrocarbon exploration and appraisal operations. Data on aquatic effects are not available. The Alabama Oil and Gas Board also sampled at Lease Section 39.

4.294 Used drilling fluids and cuttings, along with other liquid waste such as stormwater and wastewater, would be transported by barge to an on-land disposal site. In an accidental spill from a waste transport barge, as much as 5,000 barrels of liquid and solid wastes could be discharged into the Delta access canal or waterway.

4.295 If a barge load of used drilling fluids was spilled, most of this material (the heavier fractions) would sink rapidly to the bottom at the site of the spill. One effect of a spill of used drilling fluids would be an alteration of the texture and chemical composition of the affected bottom. The solid material (drilling muds and cuttings) could be contaminated with potentially harmful additives such as diesel fuel (used as a lubricating additive) and biocides. If spilled in an access canal, the liquid portion of the load could contain toxic material causing mortality within the canal. Toxic materials in the solid fraction spilled to the bottom could leach out and have some continuing localized effect. If not removed after the spill this material would be buried when the canal was refilled upon abandonment of the well site. Lighter fractions of the drilling fluids would accumulate on the surface as described in paragraph 4.275. Depending on the constituents of the buried material, some localized contamination of groundwater could result.

4.296 If a barge of waste mud spilled in a natural waterway, localized effects could also occur. Some mortality could occur downstream of the spill if toxic materials were present in the liquid fraction of the waste and dilution was not rapid. Distribution of the solid material through bedload transport and resuspension during high flow periods could increase the area affected but also serve to dilute material concentrations by mixing with uncontaminated sediments.

4.297 The biological effects of the drilling mud remaining in the channel sediments would depend on the presence of contaminants in the mud. If heavy metals are present some increase in metals in the tissues of aquatic organisms could occur locally. The value of the benthic habitat affected by the spilled material could be reduced until toxic materials, if present, are degraded, diluted to low concentrations, or buried below the biologically active zone.

4.298 A recent accident resulting in a barge spill occurred at a landing area on the Mobile River near Mt. Vernon. An explosion of

unknown cause occurred on November 18, 1983 within a waste hauling barge, causing the barge to partially sink. The State of Alabama is currently investigating this event.

Chemicals

4.299 A variety of materials such as hydrochloric acid, drilling fluid additives, lubricants and rig paints would be used and stored at the drilling site. Any spill of this material would likely be small in volume. Some localized mortality could result.

Natural Gas Containing Hydrogen Sulfide

4.300 Loss of well control resulting in a flow of gas into the water column could occur. This gas, which is under high pressure, would pass through the water column and most of it would enter the atmosphere. A small portion would dissolve in the water and be subject to chemical and biochemical transformations. The quantity of this dissolved fraction would depend on the gas constituent, its partial pressure, its duration of exposure to the water column, the water temperature and salinity. The solubilities of pure methane, hydrogen sulfide, and carbon dioxide in pure water at 20°C are 23.6 mg/l, 3,925 mg/l, and 1,720 mg/l, respectively (Camp and Meserve, 1974).

4.301 Very little methane would dissolve because of its low solubility. Methane is also a natural input from anaerobic sediments within the Delta.

4.302 Carbon dioxide would be of concern above 60 ppm (U.S. Environmental Protection Agency, 1976). Dilution by water flow and natural buffering systems would likely prevent this concentration from being achieved.

4.303 Sulfide concentrations exceeding 0.02 ppm constitute a hazard (U.S. Environmental Protection Agency, 1976). Dissolved hydrogen sulfide gas, however, would be oxidized rapidly with the production of elemental sulfur or sulfate (Camp and Meserve, 1974). Thus, in the aerobic river waters, the major effect of biological concern would be a local reduction in oxygen concentration, which partially would be offset by the entrainment of oxygen from the atmosphere in the turbulent action of the bubbling gas and the dilution from current flow.

4.304 Release of natural gas under high pressure through the well casing below the sediment surface could also cause physical destruction of benthic area from the formation of a crater at the well site. The size of the crater would depend on the length of

time of uncontrolled flow, the pressure of the gas, the soil characteristics at the well site, and the location of the well. The crater formed would probably be confined to the slip area if a drilling barge was used at the end of a canal. A larger crater could form at a site adjacent to or in the river channel.

4.305 Large quantities of sediment would be ejected into the water column during the formation of the crater. This sediment, if released in the river channel, would settle downstream, burying benthic organisms. Sediment ejected into a slip would probably be more contained, but some would probably reach the river channel.

Groundwater Effects of Accidents and Spills and Loss of Well Control

4.306 The impact of hydrocarbon development on the fresh-water-bearing aquifers along the Alabama and Mississippi coasts should be minimized through implementation of proper techniques and mitigative measures. However, due to the complexity of the development processes and the inherent nature of the product, a potential threat to the area's sensitive groundwater resources is posed through accidents and spills.

4.307 A wide range of accidents such as fires and loss of well control can lead to the release of pollutants to the environment. However, not all accidents have potential for contaminating ground-water resources. Those accidents which can impact underground freshwater resources are listed in Table 4-11, along with measures for control or prevention.

4.308 Spills can occur from three general sources; these are drilling rigs and production facilities, transport vessels, and pipelines. Most harmful to the fresh water-bearing aquifers are water soluble chemicals and components of petroleum products (Table 4-12). Groundwater contamination from such sources may occur suddenly or may be the result of a slow leak over a period of time.

4.309 Spills onto soil will tend to flow downward with some lateral spreading. The rate of this movement depends on the product itself as well as the properties of the soil and substratum. Pollutant uptake, degradation and rate of percolation in a soil are a function of chemical, microbial, and physical factors. The fate of particular constituents are determined by such processes as physical retention, adsorption on solid surfaces, plant and microbial uptake, microbial degradation, volatilization, leaching, chemical breakdown and precipitation (Davis et al. 1972; American Petroleum Institute, 1980; Law Engineering Testing Company, 1982).

TABLE 4-11

ACCIDENTS AFFECTING GROUNDWATER

Accident	Impact on groundwater	Preventive or Corrective action
Collapse of well hole	If collapse is in water-bearing formation, drilling fluids will be introduced into aquifer to the limit of affected area.	Cementing of casing will seal off affected area.
Wellbore fluids lost to water-bearing formation	Introduction of fluids into aquifer. Possible salt, chemical or heavy metal pollution to an otherwise useful water source.	Add "lost circulation" controlling material (e.g., walnut hulls, sawdust, chopped cellulose, straw, chopped inner tubes, ground mica, cottonseed hulls, shredded wood fiber or cellulose). Most of such additives will remain in the formation. Cementing of casing will seal off affected area.
Casing rupture	If rupture is opposite a water-bearing formation and if cementing ruptures also, formation fluids will enter aquifer if pressure is greater than artesian pressure in aquifer. Casing rupture may also allow flow of drilling muds or formation fluids to higher or lower strata or even to surface. Pollution may occur if direct contact in strata occurs or infiltration from surface if rupture causes a surface spill.	Proper management of drilling fluid densities and pressurization during hydrostatic fracturing should minimize potential for casing ruptures. Following an occurance the casing must be repaired or replaced, if possible.
Equipment structural failure	Leakage of hydrocarbons, or other contaminents, onto soils and percolation into the shallow aquifer systems.	Frequent inspections of equipment, replacement of worn or fatigued parts. parts. Immediate cleanup of any spills.
Well blow out	Circulation of drilling muds and other fluids to the surface as a spill with subsequent impact to surface aquifers due to infiltration. If well contains hydrogen sulfide, any water source contacted will become polluted.	Proper management of drilling fluid densities should prevent blow out. Following occurance spills should be expeditiously removed.

TABLE 4-12

POTENTIAL SPILL MATERIALS

Source	Material	Impact on groundwater
Drilling rigs	Drilling muds and cement	Potential contamination of shallow aquifer by chlorides, hydrocarbons or other chemical constituents minor, unless long term infiltration occurs.
	Chemicals and cements	Potentially harmful if water soluble.
	Fuel oil	Potential contamination of shallow aquifer. Only a few mg/l render water unfit for consumption.
	Brine, enhancement fluids	High potential for chloride contamination of shallow aquifers from brine spills. Chloride and heavy metals may contaminate from spills of various enhancement fluids.
Transport vessels (barges)	Wastewater, solvents, lubricants, drill muds, drill cuttings, garbage, stormwater	Potential for chloride, metal, hydrocarbon or chemical contamination of shallow aquifer minor if spilled in open waters due to dilution.
Pipelines	Oil and gas	Potential hydrocarbon contamination of shallow aquifer.

4.310 The overlying soil layers may provide an effective means of treatment. However, a portion of the soluble component of the liquid may pass through the soil to the groundwater table. If the source of the contamination is not removed, the soil matrix will eventually reach a saturation level and will no longer provide effective treatment. As a result of these processes the quality of groundwater beneath a spill will vary with time. The more soluble components may appear first, followed by a gradual leaching of the more insoluble components. Spills on soil or in water may be carried laterally by runoff or by surface waters to points of groundwater recharge, thereby accelerating infiltration and contamination processes. The more prevalent soluble, toxic or obnoxious (taste or smell) constituents of petroleum products include xylene, toluene, benzene, naphthalene, ether and alcohol.

4.311 A number of petroleum-related groundwater contamination problems have been studied (WWJ, 1981; American Society of Civil Engineers, 1981; Huddleston and Creswell, 1976; O'Connor, 1981). This information has revealed that in the majority of cases the specific contaminant concentrations are quite low (less than 130 mg/l TOC), although higher concentrations have been reported in some instances. In most cases, gross pollution of the water table and capillary zone occurs as a buildup of pollutants at or near the water surface. Spreading of this contamination may be controlled by a number of means and partial treatment of these waters can be provided by separation devices. However, at least some toxic hydrocarbons are water soluble and much more difficult to control and remove by traditional means.

Socioeconomic Effects of Spills and Loss of Well Control

4.312 Any accident at a well site that damaged fish or waterfowl in the Delta could adversely affect the recreational uses of the water body by hunters, boaters and fishermen. Spring is the busiest fishing season. If a large uncontained oil spill occurred at the height of the season, and if residues lingered for weeks, severe economic losses would result to area retail businesses. The magnitude of the losses would vary according to the severity of an accident and the efficiency of clean up efforts.

4.313 Mid-November is the beginning of the waterfowl hunting season. An oil spill occurring in the fall could affect the migrating waterfowl and in turn the hunters and the purchases they make.

Accidental Release to the Atmosphere of Natural Gas Containing Hydrogen Sulfide

4.314 A well blowout is a more serious accident than a line break. Traditionally, it is modelled using the CRSTER model. The results of such modeling have also assumed a ground or near-ground release. Such conservatism appears to be warranted in future offshore blowout considerations. The highest projected hydrogen sulfide concentration postulated in recent applications filed by Mobil Oil Exploration and Producing Southeast, Inc. (1981a) associated with an unflared blowout was found to be 330 ppm at 0.1 mile from the blowout site. The maximum probable 1-hour H_2S concentration was as high as 200 mg/m^3 or as low as 29 mg/m^3. The significance of these concentrations are as follows:

o Threshold (assigned by OSHA) - concentration to which it is believed that a normal healthy worker may be repeatedly exposed eight hours/day without adverse effect	10
o Hazardous - concentration which will cause a serious illness or death	500
o Lethal - concentration which will cause death with short-term exposure	800-1000

A well blowout was estimated by the U.S. Geological Survey (U.S. Army Corps of Engineers, 1982a) to have a probability of 0.004 or one blowout for every 250 exploratory and developmental wells.

PRODUCTION

4.315 The production phase for an oil and gas field consists of those activities required to bring the oil and/or gas to the surface through the wells drilled in the field, transport the hydrocarbons from each well to a central gathering station for treatment and temporary storage, and maintain profitable production flow rates over the life of the field. A more detailed discussion of production activities is given in Appendix A.

4.316 Activities that must be carried out before recovery of the hydrocarbon resource can commence are as follows:

- o Well completion activities
  - Stimulation of the geological formation (may not be required)
  - Installation of wellbore and wellhead production equipment

- Construction activities
  - Production platform at well site
  - Pipeline gathering system
  - On-land hydrocarbon treatment facilities
  - System for transport to intermediate market

Once facility construction is completed, recovery of the resource begins. Maintenance, servicing and normal operating activities necessary during production include the following:

- Servicing and maintenance of the wells.
- Well workover.
- Pipeline inspection and repair.
- Pipeline corridor maintenance.
- Servicing and maintenance of treatment facility.
- Liquid and solid waste disposal.
- Sale of treated hydrocarbons and recoverable byproducts.

4.317 After a period of time, the natural flow of oil to the surface may cease and artificial lifting methods may be employed. These include the installation of pumps at the wellhead or the injection of fluids or gases into the formation to force the remaining oil up the wells or to increase the quantity of oil recovered (enhanced recovery).

4.318 Discussed in this section are the environmental loadings and generic effects of production activities that would take place within the Delta boundaries. Associated activities that would occur on adjacent uplands are discussed in Chapter 7.

Well Completion

4.319 Completion of the well involves the treatment of the geological formation (if needed) with acids or liquids under high pressure to increase the flow of hydrocarbon, treatment of the wellbore to ready it for production, and the installation of casing, tubing and wellhead flow regulating devices necessary to produce the hydrocarbon. The rig used to drill the well may be used for well completion or a smaller servicing rig may be brought in to replace the drilling rig.

4.320 Formation treatment involves the injection through the well of acidic liquids or the use of hydraulic fracturing techniques to increase the permeability of the reservoir. Large volumes of

liquids containing acids and other chemicals may be used, which must be removed through the wellbore eventually in order to insure optimum production from the well. Formation treatment activities may require large numbers of vessels and people at the well site at once. No modifications to the drilling site or access system alternatives discussed for the drilling phase would be necessary to carry out formation treatment activities.

4.321 Installation of wellbore and wellhead equipment is necessary to control the hydrocarbon flow to the surface. Equipment required includes casing and tubing in the well and a flow regulation device (Christmas tree) at the wellhead on the surface. A subsurface safety device must be installed that would prevent loss of well control during production flow. For the platform drilling alternatives, all activities would take place on the platform and the platform would be left in place for use during well workover. For the inland drilling barge alternatives, the installation of casing, tubing and wellhead equipment would be carried out from the original drilling barge or a smaller one substituted for it. The barge would then be removed and a small pile-supported platform constructed around the wellhead for well servicing requirements. The canal and slip would remain open to allow access for well servicing and workover.

4.322 Sometimes the well is temporarily abandoned at the completion of drilling until other facilities are constructed or other factors change, making production feasible. In this case, the well would be partially filled with cement, capped, and a small protective cassion erected around the wellhead. These features would be removed when production was to begin.

Water Quality

4.323 Impacts to surface water quality during these activities would be due to boat and barge traffic bringing in supplies and personnel and, where a drilling barge is used, construction of a drilling platform may cause increases in turbidity. Impacts due to boat traffic depend upon the type of access to the well and would be the same impacts as listed for drilling. Impacts of spills are discussed elsewhere in this chapter.

Hydrology

4.324 Water circulation and bank erosion would only be affected due to well completion activities by the short-term increases in boat and barge traffic. Effects on water circulation would only be noticeable within a few minutes following boat and barge movement. Bank erosion would depend upon the extent of wake

development due to boats and barges and also would depend upon erodability of river bank soils.

Wetland Ecosystems

4.325 No new effects would occur to wetlands during well completion.

Aquatic Ecosystems

4.326 Aquatic ecosystems would continue to experience effects typical of those during routine drilling operations.

Wastewater Disposal

4.327 Well completion chemicals must be removed from the wellbore after being utilized and subsequently treated and disposed in a proper manner at an upland site. All wastewater management activities would be conducted in the same manner as during the drilling phase.

Groundwater

4.328 Most completion activities will have little routine potential for groundwater contamination. However, if fracturing is employed to aid in formation flow, the possibility exists for overpressure of the casing during hydrostatic fracturing which could cause casing failure and allow fluids to escape into other strata, some of which may be aquifers of concern. The presence of surface and intermediate casings around the pressurized casing would, however, make the potential for loss of fluids much less likely.

Air Emissions

4.329 Air emissions associated with this activity are shown in Table 4-3.

Noise

4.330 The principal sources of noise during well completion would be associated with delivery trucks or barges, geophysical logging vans/trucks or on-site laboratories, hoists, forklifts, motors, explosives, cement trucks, and cement pumps. The noise levels of several of these or similar sources are listed in Appendix E. Noise associated with pipeline stringing and blasting may also be similar to setting casing and casing/cement perforation, respectively, although the explosion noise during perforation would be dampened since charges would be set off.

4.331 Installation noise of one or more wellheads (Christmas trees) would be minimal, emanating from truck component delivery and from welding activities (See canal and slip for an inland barge; Maximum = 87 dBA).

Solid and Hazardous Waste

4.332 Large volumes of solid waste are not usually produced during well completion activities. What solid waste is generated principally originates from the drilling fluids. The waste is barged to shore where solids are extracted, treated and disposed of or recycled.

Socioeconomic Characteristics

4.333 Well completion is one of the busiest phases in terms of labor and traffic (Appendix A). Many crews are brought in for specialized jobs.

4.334 Employment. It has been estimated that in addition to the standard crew of 20 to 36 at the drilling site at any one time, as many as 15 more individuals could be required on site during the completion phase in the Delta. To accommodate the increase in personnel a special quarter's barge can be scheduled to be on site during this period (Settoon, 1983, personal communication). At a minimum, well completion would take between 10 days and 3 weeks.

4.335 Maximum personnel numbers are not easily determined because several variables are involved. For instance, the operator may ask the well loggers (a wireline firm) to be on site at a certain time and request a casing and cementing crew to arrive at a time following the loggers estimated time of completion. Frequently, the logging could take longer than expected so two specialized crews would be on site at once rather than one at a time.

4.336 In addition to a quarters barge, it has been estimated that twice as many supply barges would be required during well completion (Settoon, 1983, personal communication). At least one more tug would be needed also. It is likely that a local firm would have the best bid for the work, and be hired on a short term basis, making this aspect of well completion a minor contribution to local business.

4.337 If a platform and modular rig were used instead of an inland barge, the same basic practice would occur during well completion. However, since fewer people are involved with the operations in a land operation, fewer personnel would be on site during well completion. Temporary traffic increases at a landing

and a site would be expected from trucks and other equipment needed during this phase.

4.338 Platform Installation. Temporary abandonment of a well can occur when an operator must wait for a mode to transport the hydrocarbons to processing facilities or storage; it may also occur as a response to market conditions. When a well is temporarily abandoned it is completed and sealed and a small protective caisson is erected to prevent damage from weather or vessels (U.S. Corps of Engineers, 1982a).

4.339 If a drilling barge were used to drill the well, a production platform must be installed to support necessary production equipment and provide access to those individuals servicing the well during the course of its life. Production platforms in the Delta would be relatively small. For instance, a Superior Oil production platform is designed with dimensions of 14 by 20 feet (Superior Oil Company, 1982a). This type of platform would be prefabricated.

4.340 The platform designed for the Delta by Superior Oil could be typical of others that might be constructed in the wetlands. Although an out-of-state firm won the bid for construction, local area businesses could compete (Settoon, 1983, personal communication). The smaller platforms potentially could be constructed by a firm that does not specialize in large offshore platform production.

4.341 Once a platform is built in modules it is barged directly to the site for installation. An operator may have the capacity to barge and install the platform, but this activity is also contracted out. Initially, several steel piles are driven to support the deck and equipment. A small crane would be needed to lift the pieces in place and a maximum crew of 10 would assemble the modules. Pile driving and platform installation in the Delta should not require more than a few days (Settoon, 1983, personal communication).

4.342 A minimum amount of equipment on a platform in the Delta is desirable to reduce the area of possible disturbance. In addition to the Christmas tree, a platform designed for the Delta would be equipped with only a sump pump driven by gas from the gas lift line to pump the water that collects on the structure for disposal by injection.

Navigation

4.343 The waterway traffic that would occur due to well completion activities would primarily be crew boat and supply barge movements. Crew boat movements would generally range from 3 per day on a barge rig to 9 or 10 a day on a platform-mounted rig operating under land rig conditions. An additional two or three trips may be required on a given day for company personnel involved in the treatment operations. The delivery of formation treatment liquids and the removal of waste material would probably require at most, one barge round trip a day. This frequency would depend on the volume of treatment material to be used.

4.344 During formation treatment, a short-term concentration of many vessels may occur at the well site. For a drilling site in a natural waterway, the concentration of vessels could increase the risk to navigation.

Gathering System Construction in Wetlands

4.345 A pipeline gathering system must be constructed to transport the hydrocarbon from the wells to the central treatment facility. In the Delta, pipelines from each well may go directly to adjacent uplands or to a central location from which a single corridor to the upland treatment facility would be used. The design of a gathering system layout may be determined in part by such considerations as the need to minimize the amount of the system in wetlands and the number of channel crossings required.

4.346 In general, gathering system pipelines are small diameters (6 to 10 inches). To reduce costs, lines to be used in the future for enhanced recovery procedures may also be installed in the gathering system trenches at the time of construction of the gathering system.

Water Quality

4.347 Impacts to surface water quality due to gathering system construction are the same as those described for site preparation for a canal and slip. The severity of the impact is less for the push method than the flotation method because of the much smaller trench required for the push method. If the trench/canal is not backfilled, it will have the same impacts as those described for routine operation for a canal and slip. If the trench/canal is backfilled, local temporary increases in turbidity may occur.

Hydrology

4.348 The high water content and organic nature of the excavated material leads to shrinking of the spoil piles. Consequently, there is rarely enough material to fill the trench/canal to the original contour. This shrinking would leave a depression which may promote draining, water intrusion, and erosion. Erosion due to runoff would decrease once the barren soil is revegetated. If pipeline trenches within wetland soils of the delta are not refilled, flood waters could flow through the trenches at much higher velocities than through the undisturbed wetland. Such higher velocities could accelerate drainage of the wetland and also increase the rate of soil erosion. In the southern Delta, saline waters from Mobile Bay could penetrate much further into the Delta if trenches are hydraulically connected to tidal flows from the Bay.

Wetland Ecosystems

4.349 Wetland areas would be altered through the clearing of a right-of-way to accommodate equipment movement, trenching, and backfill operations.

4.350 Wetland Area Required. For a 3 to 5 pipe gathering system (flow line, formation-water line, gas lift line, and spares), a right-of-way of 35 to 45 feet would be cleared (approximately 1 acre per 1000 feet of gathering line). Within this cleared area, the pipe ditch would be excavated to a depth of four feet. The top width of the ditch would vary with the number of pipes in the gathering system and the amount of slope required to prevent excessive sloughing of the sides of the ditch. For a top width of 10 to 15 feet, the area disturbed by excavating would be about 1/3 acre per 1000 feet of gathering system and about 2/3 acre per 1000 feet for the dredged material stockpile and working area.

4.351 Generic Ecological Effects. Within the pipeline corridor, biological productivity and wildlife habitat would be eliminated during the construction and pipeline testing period because of the removal of vegetation, digging of a trench, placement of material adjacent to the trench and use of construction machinery within the right-of-way. The trench would remain open for a number of days depending on the length of the pipeline segment. After testing the trench would be refilled to original contours and the right-of-way seeded with grasses.

4.352 During the short period of time until the trench is refilled and revegetation begins, all wetland values within the right-of-way would be eliminated. These effects are the same as those described for construction and operation of a canal and slip

system for a drilling barge. In summary, these areas provide organic material to the detritivore food chain of the Delta, adjacent aquatic communities of the waterways and to Mobile Bay downstream and as spawning and feeding habitat for fish and migratory waterfowl during period of inundation.

Groundwater

4.353 Potential impacts to groundwater from construction of gathering systems are minor and similar to those previously discussed with site preparation.

Air Emissions

4.354 Air emissions associated with this phase of development are shown in Table 4-3.

Noise

4.355 Pipeline installation may involve clearing, grading, trenching, blasting, stringing (of pipe), welding, pipe coating, lowering-in, and backfill and cleanup in onshore areas (New England River Basin Commission, 1976). Noise levels for these and other procedures are listed in Appendix E.

4.356 The Mobile River Delta pipelines can be laid over upland, wetland, and/or waterway areas, which present problems particular to each environment. Upland pipe laying could be accomplished with conventional dry-land methods and would be similar to procedures listed above. Blasting may or may not be necessary.

4.357 Wetlands crossing methods (Golden, et al., 1980) involve tasks similar to uplands pipe laying. Barges, pontoons, and/or marsh buggies could be needed to support dredging operations. Dredging would replace conventional land trenching with noise levels perhaps similar to 85 dBA at 100 feet (U.S. Environmental Protection Agency, Region IV, 1978). Blasting is typically not necessary in wetlands. Tug boats could be needed to haul barges on site and this activity might produce noise levels similar to values in Table 4-10. Backfilling is not always done but weirs are set in place at waterway intersections. If backfilling is done, it may be accomplished by dozer, crane, or excavator working from timber mats or pontoons.

Solid and Hazardous Wastes

4.358 Construction of gathering systems produces very little waste material. Dredge material remains on site and is used as

backfill. Small amounts of trash and construction waste may be produced. Potentially hazardous materials in the form of fuels and lubricants are utilized but pose minimal threat to the environment.

Socioeconomic Characteristics

4.359 Typically there are several phases of activity in a wetland gathering system pipeline which tap different labour resources or interact with different aspects of a local economy. The most significant activities are as follows: surveying, acquiring easements or purchasing rights-of-way, clearing, trenching, fitting, welding, laying the pipe, backfilling and revegetating. The details of a one-pipe pipeline recently constructed in the Mobile Delta in addition to the estimated effects generated by a proposed five line system from the Bay to southern Mobile County and information from the general literature (Clark et al. 1978; Wales et al. 1976; New England River Basin Commission, 1976) provide information on potential socioeconomic interactions specific to the Mobile area. The socioeconomic aspects of these projects are reviewed below.

4.360 Product Pipeline. Based on experience in the area and depending on the type of system laid in the Delta, a range of about 30 to 100 workers could be used. The one-line product pipeline crossed the Delta and a Mobile area firm performed the work. In all, no more than about 30 people were used to survey, clear, lay and secure the one pipe. A crew of 3 to 4 surveyors with helpers were needed in the first phase (Boyd, 1983, personal communication). Generally, after a preferred route is surveyed an attempt is made to purchase or obtain permanent easements for the right-of-way. Right-of-way acquisitions are a major monetary constraint in the construction of a pipeline (Wales et al., 1976) but they also result in a monetary influx to the local area.

4.361 After the specific areas were established for the one line system, a clearing crew of 8 to 10 workers with chain saws worked an average of ten hours a day to fell trees and clear brush. After clearing the area, the trenching began. Depending on area specific conditions, marsh equipment or upland equipment could be used in the wetlands. In either case heavy equipment operators would be needed. The trench was excavated with a backhoe, which progressed about 300 feet each day; only a few individuals were used for this phase of construction (Boyd, 1983, personal communication). Following the trenching, the one pipe was laid. Three welders, each with a helper, two wrappers, testers, backfillers, support staff, a foreman and several miscellaneous workers were required.

4.362 A Proposed Five-Line System. Estimates provided by Mobil Oil for the onshore installation segment of their proposed five-line system from Mobile Bay were much higher than the estimates given above. About 100 workers, 60 of whom would come from the local area were estimated (U.S. Army Corps of Engineers 1982a). The figures provided by Mobil Oil were based on several factors including: knowledge of the skills required, information on availability of those skills in the local area, conversations with qualified contractors, and the company's past experience (Mobil Oil Exploration and Producing Southeast Inc., 1981a).

4.363 The pipe ditch would be excavated to a minimum depth of 5.5 feet using a backhoe or similar equipment in uplands. For the five line system the pipe would be distributed along the route; a sling-equipped side boom tractor would lower it. Lighter machinery possibly working off mats would be used for wetland areas. After welding, the pipes would be flotation installed, as required, and pushed across the wetlands (Mobil Oil Exploration and Producing Southeast, 1981b).

4.364 Effects from Pipeline Installation. Pipeline installation can have discernible economic influence on an area, which are mostly concentrated during construction. Employment, wages and taxes, purchases of services, supplies, and materials and acquisition of land and easements are all potential direct influences. Indirect economic effects would also occur, but vary in magnitude depending on the size, distance, and duration of a particular pipe system.

4.364a In 1983 a one-pipe 8-inch line onshore ranged in total construction cost from about $160,000 per mile to $178,000 per mile (Seaton, 1983). Of the total, labor required the largest single expenditure of almost $90,000 per mile. Expenditures for materials were about $48,000 for each mile, while the price for rights-of-way was about $6,000 and miscellaneous costs amounted to about $23,000 for the same distance (Seaton, 1983). A multiline system could be expected to be more expensive. However, the potential magnitude of dollar influence in a region can be gleaned from the costs of a one line system. The beneficial economic effect in an area could be substantial if labor is principally local. Benefits could accrue to the public sector through taxes and to the private sector through individual spending. Further benefits could result if material purchases were possible in the surrounding area.

4.365 The location and size of a staging area, the transportation of materials and workers can also exert an influence over an area. In the event a temporary support base was established some distance from the operation, revenues could be generated through the

rental or lease of the space (Wales et al., 1976). An on-site staging area for supplies could be provided by barges on the river or be trucked in depending on the access circumstances along the right-of-way. Truck traffic from deliveries and auto traffic from the workers could be expected to increase around such staging grounds.

4.366 The duration of effects generated by a pipeline are short lived; employment is short term and the location of intense activity moves as sections are completed. Although short term, a wetlands or uplands pipeline can provide employment for local people. Those workers who may originate outside of the local area would remain only a few months.

Construction of Pipeline River Crossings

4.367 Gathering system pipelines could be laid across waterways within the Delta by several methods:

- Boring
- Trenching
- Bridging
- Laying pipes directly on river bottom

The last alternative is generally contrary to accepted engineering practice because of the danger to the exposed pipeline to rupture by an outside force. This alternative has not been considered further.

Boring Method

4.368 In this method, a special directional drilling unit is used to drill a hole with an entrance on one riverbank, under the river channel and exiting at the surface on the opposite bank. The assembled pipe or pipe bundle is then attached to the drill string and pulled back through the hole to the drilling unit. With current technology, the maximum distance that can be bored by this method is about 4,700 feet.

4.369 Water Quality. At the river bank, erosion may be accelerated due to soil disturbances and dikes, if dikes are utilized particularly if river channel flows are high. Drilling fluids (i.e. bentonite and water) from the boring could also reach the river from the river bank.

4.370 Hydrology. Any dikes would alter water circulation along the river bank for a few hundred feet downstream of the bank. Circulation would only need to be altered as long as a dike is in place.

4.371 Wetland Area Required. At the river bank location for a directionally-drilled river crossing, the special drilling rig and its support components would require a cleared area of approximately 1/2 acre. A land area of approximately 1/4 acre would be needed if the land-based components are kept to a minimum and the additional pieces of support equipment are placed in barges in an adjacent channel. This area would be cleared and in most Delta locations, a board pad laid down. On the opposite side of the channel to be crossed, all support equipment could be contained within the right-of-way cleared for the remainder of the pipeline. (It should be noted that with this method, the area between the pipe entry and the river bank and the area between the pipe exit point and the opposite river bank would not be disturbed at all).

4.372 Generic Effects on Wetlands. Biological productivity and wildlife habitat would be eliminated on the 1/2 acre occupied by the drilling unit and on the pipeline corridor on the exit end during the period that the boring activity occurred. All wetland values would be lost during this time. These have been discussed in the section on construction of gathering systems in wetlands.

4.373 Wastewater Disposal. Activities related to wastewater would be the same as for a pipeline system being installed through delta wetlands. Wastewaters from well sites would be stored in holding tanks and disposed properly at an upland location. With the construction crew commuting each day to the site, wastewater would be generated at flows less than 20 gallons per person per day.

4.374 Air Emissions. Air emissions associated with this activity are shown in Table 4-3.

4.375 Noise. Water crossings can be accomplished by bridge construction, waterway trenching, or directional drilling. In terms of noise, these methods would be similar to land pipe laying, although noise from steel bridge construction (truck delivery, component handling, welding) and directional drilling as opposed to dredging would be additional or differ from noise produced during conventional methods. Noise from blasting and backfilling activities would be eliminated during waterway crossings.

4.376 Solid and Hazardous Wastes. This gathering system construction alternative varies from that previously described in that drilling fluids (simple bentonite muds and possibly some additives) are produced. On the entry side fluids are contained in a tank on the rig for disposal at an approved onshore site. At the exit end some fluids will spill on the ground until such time as the exit hole can be located. This possible spill of mostly intact muds would be limited to a portion of the volume of bore hole.

4.377 Socioeconomic Characteristics. A typical crew for a boring operation would consist of about 30 individuals; 15 on the side with the drilling rig, and 15 on the side with the pipe to weld, wrap, test and prepare pipe for pullthrough. There are contractors with specialized crews to perform this kind of work. On the average such a crew would be able to complete the job in four to six weeks working six days a week, ten hours a day (Hair, 1983, personal communication). Ordinarily the workers would be housed in a nearby motel. Because specialized crews are used, there is little employment opportunity for the local labor pool. However, the boring crew could be expected to benefit local business through lodging and food purchases.

4.378 Staging activities in the Delta region could be located on barges. A board pad would be laid to support the drill rig, pipe, crane and surveyors office. Auto traffic could be expected to increase at a landing where the workers would meet for subsequent transport via the river to the site. A local marine servicing company could be contracted to shuttle personnel daily, thus adding to the minor benefits resulting from this phase of activity.

Trenching Method

4.379 A pipeline may be laid across a channel in the Delta by excavating a trench and placing the pipeline in it. Excavation may be by hydraulic suction dredge or dragline. Depth of the trench would probably be 5 to 7 feet, except under navigation channels, where depth over the pipeline would be a minimum of 10 feet.

4.380 Water Quality. Dredging a trench across a river channel would result in increased turbidity and resuspension of various substances absorbed to or mixed in with sediments as discussed for canal and slip dredging. If a bucket dredge is used, spoil would be placed alongside of the trench. If a hydraulic dredge is used, spoil would be placed either alongside of the trench or in spoil piles on the banks of the river. A hydraulic dredge pumps scarified sediment from the trench; the sediment is then discharged through a pipe. Typical suspended solids concentrations within 10 feet of the suction pipe are as high as a few tens of grams per liter, but the concentrations rapidly decrease downstream of the trench (Barnard, 1978). Placement of the spoil alongside the trench would further increase turbidity from the placement of the spoil and from the eroding of the spoil pits due to the river current. If spoil is placed on the river bank, runoff from the spoil pile, containing high solid concentrations, may flow into the river. Spoil from scarred main river channels would be coarser and settle more quickly from suspension. After placement of the pipe, spoil is used to backfill the trench in order to protect the pipe. Soil replaced

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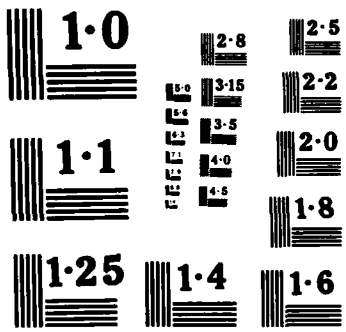

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after the piping is installed is less consolidated than undisturbed soil and would therefore be more likely to be suspended in solution.

4.381 Hydrology. Water circulation would be temporarily affected by the dredging barge and exposed pipeline trenches at the bottom of the river channel. Current eddies would form and extend perhaps as far as a few hundred feet downstream of the pipeline crossing. Once the crossing installation is completed, water movement within the river channel would no longer be affected.

4.382 Wetland Ecosystems. The major wetland disturbance would be a result of the temporary dredged material holding areas associated with hydraulic suction dredging. These dredged material holding areas adjacent to a waterway must be large enough to accommodate the excavated bottom material and water to insure that run-off water has sufficient retention time for settlement of suspended materials prior to being discharged to the waterway. For most hydraulic dredging operations, diked dredged material holding areas are constructed on each side of a waterway. Such diked areas can cover from 5 to 6 acres on each side or from 10 to 12 acres per waterway crossing. The exact area required would depend on the length of the waterway crossing and on the nature of the material being dredged. An additional temporary working area of about 1/3 acre would be required on each side of a waterway.

4.383 If a dragline is used to excavate the trench and the spoil is deposited on the waterway bottom adjacent to the trench, the wetland area disturbed would be limited to the area where the river bottom pipe is connected to the landward portion of the pipe. This would be approximately 1/3 acre on each side of the waterway. The effect of the alteration of wetland area has been discussed for the canal and slip drilling alternative.

4.384 Aquatic Ecosystems. The pipelaying operations would temporarily destroy benthic communities, greatly reduce the value of benthic habitat until recovery occurs, and affect adjacent areas from the resulting turbidity. The area of benthic community destroyed by trench dredging and placement of material would be about 1 acre per 1000 feet of pipeline length. Some additional effect could occur downstream of the stockpiled material from erosional loss and redeposition.

4.385 The effect of the temporary direct loss of the existing benthic community and habitat area has been discussed under the canal and slip drilling alternative. For the deeper flow channels, the principal effect is the loss of the biological productivity of the benthic area that serves as a food source for the aquatic food web. In the shallow bays of the southern Delta, an important

additional effect would be the loss of submersed aquatic vegetation important for nursery areas and as food for migratory waterfowl.

4.386 The effects of temporary turbidity have been discussed for the canal and slip drilling alternative. For the deeper flow channels, redeposition would affect benthic communities immediately downstream. The turbidity plume would have some effect further downstream. Because these aquatic communities are adapted to periods of natural high turbidity these effects would be short-term. In the shallow bays of the southern Delta, turbidity could temporarily reduce the productivity of submersed aquatic vegetation. If redeposition is heavy enough submersed vegetation could be lost by burial in the immediate vicinity of the pipeline corridor.

4.387 Wastewater Disposal. Wastewater would be handled in the same manner as for other types of pipeline construction (i.e., storage and transport to upland treatment facilities).

4.388 Air Emissions. Air emissions associated with these activities are shown in Table 4-3.

4.389 Noise. Trenching and the other water crossing alternatives would produce noise levels similar to those described for land pipe laying.

4.390 Solid and Hazardous Wastes. Waste materials produced by this alternative would be similar and limited to those described for gathering system construction in wetlands.

4.391 Socioeconomic Characteristics. Barge mounted dredging equipment (mechanical or hydraulic) would be used to excavate a pipeline trench at a river crossing. An operator and assistant would manipulate the heavy equipment, while pipefitters, welders, wrappers and testers operate from a pipe laying barge. The trenching operation would be a specific activity within the pipelaying job, thus the effects on employment, the area economy and infrastructure would be essentially those already described for a gathering system.

4.392 Navigation. The hydraulic dredging operation would consist of the dredge itself and a floating discharge pipe leading to the diked dredged material holding area. As the dredge moves into the waterway, the area between the dredge and the discharge point would be closed to navigation due to the floating discharge pipe. For most waterway crossings involving navigation channels (e.g., the Mobile River), the dredge would work to about the mid point of the waterway and then the discharge pipe would be set up to

lead to a diked spoil area on the other bank. In this case, dredging operations would interrupt navigation on no more than one half of the waterway at one time. On some narrower channels, the operations may cross the waterway with a diked area on one side only. In such cases, there would be a time when the channel is completely closed to traffic. For such operations, the channel would be closed to traffic for only one or two days, at most.

4.393 A channel crossing operation using a dragline would disrupt navigation on a particular waterway to the extent that the dragline would gradually work its way cross a channel and for a period of time would be operating in any navigation channel on a particular waterway. Such operations would not block a navigation channel but would require careful operations by any vessel passing through the area of dredging operations.

Bridging Method

4.394 A bridging system could be used to carry gathering system pipelines across river channels. Piers would be constructed on both river banks. The pipeline is then suspended between the piers at a safe height over the channel.

4.395 Use of this method is very unlikely in the Mobile Delta and is not considered in detail here. If used, the main effects would be the loss of perhaps 1/2 acre of wetlands for bridge pier placement on each side of the channel and temporary minor turbidity during construction.

Normal Operations of Wells and Pipeline Gathering Systems

4.396 Once construction of facilities is completed, production of the hydrocarbon resource through the system commences. Production may last from just a few years for a small field to decades for a large one.

Water Quality

4.397 Surface water quality effects from producing wells would be limited primarily to resuspended sediment and engine exhaust products from boat trips to and from the wells for inspection. Wells are usually inspected from once per day to once per week.

Hydrology

4.398 Hydrological impacts due to the continuing presence of access canals and slips, trestle roads, board roads, etc. would be

the same as those described in previous sections on site preparation. Pipeline canals/trenches that have not been backfilled would have the same hydrologic and water quality impacts as access canals, including some loss of the ability of the entire wetland to maintain favorable water quality conditions.

Wetland Ecosystems

4.399 The loss or reduction of biological productivity and wetland values of wetland habitat lost to canals and slips, under drilling platforms and trestle roads, or within a board road and ring levee system would continue for the productive economic life of the field. These losses could continue for only a few years if the field is small or continue for decades if the field is large.

4.400 Canals, Slips, Board Roads, and Borrow Pits. Wetland productivity would continue to be completely lost in these areas for the life of the well site which they served. In summary, effects would include the loss of sources of detritus to the food web of the Delta and Mobile Bay and of spawning and feeding habitat for aquatic organisms and migratory waterfowl during periods of inundation.

4.00a Dredged Material Piles. Revegetation of dredged material piles would take place during the production period. The area of material storage piles for slips would be about 2 1/2 acres. The area for canals would be 3.5 to 4 acres per 1000 feet of length if constructed for a standard drilling barge or 3 acres per 1000 feet if for access to a drilling platform. Ring levees would be about 1/2 acre per 1000 feet of length if 4 feet tall, more if the levees are taller.

4.00b The vegetation community that would develop on material storage piles may be wetland or upland species depending on soil composition and elevation of the pile. Considerable compaction of material and resulting reduction in height of the piles has occurred at existing canals and slips within the Delta. The composition of the vegetation communities on the piles has not been studied but observation indicates that species succession could proceed differently depending on the particular characteristics of each site. Some observational evidence indicates that recovery of the sites could occur as quickly as within 30 to 50 years, as appears to be the case for material piles adjacent to the dredged channel connecting the Mobile and Tensaw Rivers (see Abandonment section, paragraph 4.529).

4.400c The biological productivity of the revegetating dredged material piles would be less than adjacent areas initially and gradually increase as the climax state is reached if the piles

remain in place that long. Wetland values such as detritus production and suitability as spawning and feeding habitat would increase as the biological productivity increased.

4.00d In the treeless southern Delta it is likely that mostly upland woody species would develop on dredged material piles since small differences in elevation can make a large difference in type of vegetation in this area.

4.401 Drilling Platforms and Trestle Roads. Biological productivity of areas under drilling platforms or trestle roads would be reduced or eliminated for the productive life of the field since these structures would remain in place. The area involved would be about 1/2 acre for a drilling patform and about 1/2 acre per 1000 feet of trestle road. The contribution of organic matter to aquatic systems would be reduced, but some habitat value would remain because the area would still be available during periods of inundation.

4.402 Pipeline Corridors. Within the gathering system pipeline corridors, revegetation would occur after refilling of the trench, grading of the right-of-way and reseeding to prevent erosion. The area affected would be about 1 acre per 1000 feet of right-of-way.

4.403 In the forested portion of the Delta, larger woody vegetation would be removed periodically from the restored right-of-way so that there would be no impediment to periodic inspection of the corridor for leaks or other problems. Corridor maintenance would probably be by hand cutting but possibly with herbicides, so that the vegetation community remaining would probably be typical of that occurring on existing rights-of-way that cross the Delta, such as power lines and gas and oil transmission lines. No study has been made of these existing corridors but it is likely that the vegetation would consist of grasses, low shrubs and herbaceous growth.

4.404 Once restored, the right-of-way would regain some wetland values, such as availability for feeding and spawning during periods of inundation and as a source of organic detritus. Because biological productivity within the corridor would not be as great as before, all previous wetland value would not be regained. Habitat diversity would be increased in the vicinity by the maintenance of early successional vegetation in the corridor.

4.405 Within the southern Delta where emergent grasses are the climax community, the pipeline corridor may recover to its original condition if soil structure and elevations are not too altered.

During the period of recovery (perhaps 3 years) productivity would increase to the original level. During the remaining life of the field wetland values similar to adjacent areas would exist.

Aquatic Ecosystems

4.406 Normal operations of wells, pipelines and treatment facilities would have little effect on aquatic ecosystems of the main flow channels of the Delta. Where pipeline river crossings were accomplished by trenching, recovery of the area disturbed by the trench and dredged material deposition would recover rapidly upon refilling of the trench, probably within 2 years.

4.407 New aquatic habitat would be created within canals that were constructed for the drilling phase and remained for access during the operation phase. No studies have been undertaken on the aquatic communities that have developed within existing canals in the Delta. In most of the Delta, it is likely that the community composition that develops would be similar to that of the adjacent natural channels. If low oxygen develops in the bottom waters, recovery could be slight. The time necessary for these new aquatic habitats to develop would probably be rapid (within 2 to 5 years).

4.408 Once established, the canal communities are not likely to be disturbed significantly over the life of the field, since observations of existing canals suggest that maintenance dredging would not be required. Some slight periodic disruption of the canal communities could occur from recreational and well service boat traffic.

4.409 In the shallow bays of the southern Delta, aquatic habitat altered by channel dredging for drilling site access would continue in an altered state for the life of the field. Because of the depth of the channels it is likely that these areas would not be suitable for submersed aquatic vegetation, thus making these channels less desirable as feeding areas for migratory waterfowl. The community that would develop would probably be more like that of adjacent deeper flow channels. The area within these channels would be about 3 to 4 acres per 1000 feet of length.

4.410 Bay bottom covered by material dredged from the channels would be recolonized by benthic organisms, probably within 2 years. Regrowth of submersed aquatic vegetation would probably occur, with depth being one determinant of the species established.

4.411 This paragraph has been deleted in the FEIS.

4.412 This paragraph has been deleted in the FEIS.

Wastewater Disposal

4.413 Quantities of wastewater produced during the production phase are much smaller than that produced during the drilling phase. Well site runoff, some sanitary wastewaters and some liquid chemicals would be stored on-site for periodic removal via barge on tank truck to approved wastewater treatment and disposal location.

4.414 Normal operations at well sites during the production phase would result in formation waters, sanitary wastewaters and various liquid chemicals that need to be properly collected, treated, and disposed. Liquid wastes at gas processing plants and refineries would also need to be properly managed. Formation waters are usually separated and re-injected to a geologic formation. Sanitary and other liquid wastes from a well site would be managed as discussed previously for the drilling phase (storage and transferal to an approved upland management system). Wastewaters from gas processing plants and oil refineries would need to be treated and disposed via the state wastewater permitting process. Treatment level requirements as specified in Federal regulations separately for gas processing and oil refining would need to be followed. Quantities of generated wastewater are comparatively lower from a gas processing plant than from an oil refinery.

4.414a Wastewaters from marine vessels would be treated and discharged in accordance with U.S. Coast Guard regulations governing marine sanitation devices (See paragraph 4.74a)

Air Emissions

4.415 Air emissions associated with normal operations are shown in Table 4-3.

Groundwater

4.416 Under normal operating conditions, groundwater resources do not interface with oil and gas production activities. There may be potential impact, however, should accidents or spills occur. This topic is described elsewhere in this section.

Noise

4.417 Normal operations entail inspection of pipeline gauges, compressors, pumps, and periodic clean-out of the pipeline. Noise generated during such inspection would include motorboat or swamp buggy access and minor excavations for inspection equipment. A barge and tug may be required for earthmoving equipment or inspection equipment retrieval (Appendix E).

4.418 Periodic gas venting at compressor stations can be noisy during blowdowns and pipeline maintenance. Blowdowns last 45 minutes at the line and five minutes at the compressor site. Noise levels reach 140 dBA during blowdowns and are audible within a 15-mile radius (New England River Basin Commission, 1976). Noise levels can be reduced to 80 dBA with proper control technology silencers.

Solid and Hazardous Wastes

4.419 Solid waste produced during normal operations of wells and gathering systems is minimal. Although some garbage, trash and small quantities of chemicals could result, most waste would result from an accidental spill or leakage (see section on accidents).

Socioeconomic Characteristics

4.420 Normal operations related to hydrocarbon resource development is much less labor intensive than the construction phase (Wales et al., 1976). Employment opportunities drop significantly once production platforms are set, equipment is installed, and pipelines are laid. At the same time the state can begin the collection of severence taxes and royalties and distribute the revenues to local areas accordingly. The amount of tax collected by the state is dependent on the size of the resource fields, the rate at which the hydrocarbon is extracted, and market conditions.

4.421 State and Local Revenues. If commercial quantities of hydrocarbon resources are available from a well, a new source of revenues for the State of Alabama, counties or private land owners would be derived from royalty payments and severance taxes. The severance tax is 10 percent for onshore resources including those produced in the Delta. In 1982 the total value of oil, gas and condensate produced in the state was estimated at $790 million (Bolin and Masingill, 1983). In 1983 state revenues from severance taxes amounted to $78 million . Depending on the amount of hydrocarbon resources, and market conditions, the effects from the production phase in the Delta could be significant in terms of public revenues received. The derived revenue is allocated on a pro rata basis, as established by law, to the State General Fund and to counties and municipalities in which the resources are produced (Bolin and Masingill, 1983).

4.422 Once production is underway Alabama land owners, whether public institutions or private individuals, begin receiving royalty payments. On state properties royalties average between 20 and 25 percent. The highest royalty to date has been 28%. Public lands leased between 1969 and 1971 earn royalties of about 16%. Private

land owners, however, usually negotiate royalties between 12 and 25%. The higher payments are generally negotiated for property adjacent to producing leases.

4.422a If oil were valued at $30 per barrel, $3 could be earned in severance taxes for the state (10 percent onshore resources). Gas valued at $3.45 per million BTU's would earn about 34¢ in severance taxes for each 1,000 cf produced. Assuming a royalty of 25 percent, a $30 barrel of oil would yield $7.50 payed to the landowner. A thousand cubic feet of gas, at the above value, could earn 86¢ with such a royalty.

4.423 Employees. Day to day monitoring of a well and care for surface equipment installed on a platform requires a minimum of 1 to 5 people (Settoon, 1983, personal communication; Johnson, 1983, personal communication), although as many as 16 could be involved for as many as 20 to 30 years (Clark et al., 1978; Research & Planning Consultants Inc., 1977). These individuals are trained oil company employees who may already reside in an area or are transferred in. Normal pipeline operations are highly automated and require work forces only for regular monitoring and maintenance (Clark et al., 1978). At most, a small crew of local labor may be employed as a permanent inspection and repair team for segments of the pipeline; most other activity ceases (Wales et al., 1976). Assuming an average wage of $20,000 per year during operations for direct labor (U.S. Army Corps of Engineers, 1982a) between $20,000 and $320,000 could be earned and taxed as income annually.

4.424 Although the number of job possibilities are dramatically reduced during day-to-day operations, the employment is not transient. Rather, some permanent, long-term employment would be likely, which would indirectly benefit the area from the wages, taxes, and purchases.

Navigation

4.425 Waterway traffic during normal operations would be minimal and could include one or two small craft carrying well platform inspection personnel or a periodic trip by a small crew boat transporting crews that would be used to clear larger woody vegetation from the gathering line right-of-way.

Well Workover

4.426 At periodic intervals throughout the life of a well, it may be necessary to perform well workover services in order to maintain production from the well. A well workover rig similar to the original well drilling rig would be brought to the site.

Activities carried on at the site during well workover could be of a comparable magnitude to the original operational drilling phase. Workover may require several weeks to complete. The site would be serviced by boat and barge.

Inland Barge Workover Rig

4.427 For a well site drilled using an inland drilling barge, well workover would be accomplished with a barge-mounted workover rig. Some minor site preparation may be required to repair the foundation pad on which the barge would rest, and some disassembly of platforms and wellhead equipment may be necessary to position the barge.

4.428 Water Quality. Activities during workover are similar to those described for the drilling phase. Workover may require several weeks. Impacts to surface water would be the same as those described in drilling phases. Boat and barge traffic would cause increases in turbidity and concentrations of engine exhaust. Impacts to surface water are the same type as those from drilling but are less because the timeframe is several weeks compared to many months for initial drilling.

4.429 Hydrology. As for normal operations, water circulation would be locally altered due to barges and other boats being docked near or at the production site. Eddies of current could form and alter circulation within a few hundred feet of the site.

4.430 Wetland Ecosystem. Well workover would not disturb any additional wetland area.

4.431 Aquatic Ecosystem. If some site preparation is required, temporary turbidity could affect aquatic organisms in the immediate vicinity of the wellhead. This turbidity would be similar to or less than that realized during the original construction of the foundation pad. Propwash from vessels would create temporary turbidity during normal workover operations.

4.432 Wastewater Disposal. Other than any newly-utilized chemicals that are soluble in water, the management of wastewater would be no different from those described for well completion. Compatibility of the wastewaters with other wastewaters being treated at an upland site is an important consideration.

4.433 Groundwater. Potential for groundwater contamination would be the same as or similar to production drilling.

4.434 Air Emissions. Air emissions associated with well workover are shown in Table 4-3.

4.435 Noise. Noise levels reported by Beck, et al. (1981), for some well workover indicate the operations wells and casings are 75-80 dB at 100 feet for diesel-powered drilling. Workovers also can involve materials injection or fracturing (Baker 1979). During acid pumping, some 50 to thousands of gallons of acid are pumped into the well to dissolve limestone formation rock (Baker, 1979). Pumping activities are the primary noise contributors during well workover. Such noise levels are comparable to a concrete pump (81 to 83 dBA) listed in Appendix E, since Beck, et al. (1981) indicated pumps injecting fluids during micellar-polymer chemical flood processes emit 76 dB at 50 feet. During fracturing, proppants are mixed with a fluid and injected into the well under great pressure (Baker, 1979). Noise levels would be similar to compressor pumps and concrete pumps described above. However, equipment would probably be more heavy duty than that listed.

4.436 An inland barge workover rig is similar to the original drilling rig but is typically a scaled-down version. Tug boats are needed for well servicing or workover to increase production. Servicing activities would also produce noise; levels are tabulated in Appendix E.

4.437 Solid and Hazardous Waste. Workover activities frequently necessitate operations of comparable magnitude to the original development of the well. As such, solid waste generation would be comparable to those of routine drilling and well completion operations, but in smaller quantities since workovers usually last between a few weeks and a few months.

4.438 Socioeconomic Characteristics. Under ideal conditions a workover operation would take three to four weeks (Settoon, 1983, personal communication). The crew would be about the same size as on a rig during initial drilling which is described under previous sections; the effects on the surrounding communities would also be the same.

4.439 Navigation. Waterway traffic due to well workover operations would include a barge-mounted workover rig, crew boat, and supply barges. During the workover period, the workover rig would make one round trip to the production location from its port of origin and the tug bringing the rig would return to its home port on delivery and a second tug would be used to remove the workover rig. Crew boats could make from one to three trips a day between the work area and a local boat landing for delivering and returning special service personnel. The main workover crew would stay at the

rig as on a drilling job with crew changes on a weekly basis. The delivery of supplies and the removal of waste materials could require approximately one barge trip per day at maximum activity levels.

Fixed Platform at Well Site

4.440 If well drilling had been accomplished from a platform, a modular workover rig would be brought to the platform location by barge or helicopter and assembled on the platform.

4.441 Water Quality. Workover may require several weeks. Impacts to surface water would be the same as those described in drilling phases. Boat and barge traffic would cause increases in turbidity and concentrations of engine exhaust. Impacts to surface water are the same type as those from drilling but are less because the timeframe is several weeks compared to many months for initial drilling.

4.442 Hydrology. As the workover rig is being transported and assembled, local water circulation would be altered as described for the inland barge rig. If the platform is in a slip and/or a canal, circulation would not be affected as much as if the platform is in a river channel.

4.443 Wetland Ecosystem. Well workover would not disturb any additional wetland area.

4.444 Aquatic Ecosystem. The aquatic ecosystem would experience minor turbidity from propwash of service vessels.

4.445 Wastewater Disposal. No unique aspects of wastewater management would be evident for well workover using a fixed platform.

4.446 Groundwater. The potential effects would essentially be the same as those associated with production drilling.

4.447 Air Emissions. Air emissions associated with this activity are shown in Table 4-3.

4.448 Noise. Workover rigs for platform sites differ relative to the platform size. For smaller platforms, workover rigs are towed on location and moored to the production platform after the platform deck portions are removed. For larger platforms, portable workover rigs are carried to the platform and assembled on site. These procedures would produce noise associated with rigging-up construction activities (see Appendix E).

4.449 Solid and Hazardous Waste. Solid waste generated by workover in this instance would be similar in composition as that outlined for routine drilling and completion operations. However, the magnitude of waste generated would be far less, as this activity typically lasts at most a few months.

4.450 Socioeconomic Characteristics. Well workover on a fixed platform has essentially the same requirements and effects as those described for the drilling phase.

4.451 Navigation. Waterway traffic would be the same as that for an inland barge workover rig except that crew boat traffic would range from 6 to 9 trips a day between the rig and a local landing to transport crews as they changed with each shift and to transport any special service personnel to and from the site.

Board Road and Ring Levee

4.452 The workover rig would be brought to the site by truck in pieces and assembled. Upon completion of the activity, the rig would be disassembled and removed from the site.

4.453 Water Quality. Activities during workover are similar to those described for the drilling phase. Workover may require several weeks. Impacts to surface water would be the same as those described in drilling phases for the board road-ring level alternative. Impacts to surface water are the same type as those from drilling but are less because the timeframe is several weeks compared to many months for initial drilling.

4.454 Hydrology. No additional effects are anticipated beyond those discussed for site preparation and routine operations of a board road and ring levee during the drilling phase.

4.455 Wetland Ecosystems. Well workover would not disturb any additional wetland area than had been disturbed when the original ring levee was constructed.

4.456 Wastewater Disposal. No unique aspects of wastewater management would be evident for workover of a well accessed with the board road and ring levee alternative.

4.457 Groundwater. The potential effects on groundwater would be essentially the same as those associated with production drilling.

4.458 Air Emissions. Air emissions associated with these activities are shown by Table 4-3.

4.459 Noise. The workover rig could be a truck-mounted land rig or other truck-hauled workover rig. Noise would be related to truck transportation in preparation for enhanced recovery (Appendix E).

4.460 Solid and Hazardous Waste. Waste generated by well workover at a board road and ring levee well site would be essentially the same as that described for routine drilling and completion operations except that the quantity would be less.

4.461 Socioeconomic Characteristics. Well workover at ring levee site would have the same requirements as during the drilling phase.

Enhanced Recovery

4.462 The initial flow of oil from a well is often driven by the natural pressure of gas or water in the geological formation. As the reservoir is depleted, however, this natural flow ends or becomes greatly reduced, so that production from the well must be enhanced by some artificial means. Sometimes recovery assistance methods are used from the beginning of production.

4.463 Some enhanced recovery techniques utilize the production well itself. These include the use of gas lift or pumping. Other techniques are to inject fluids or gases into the formation to maintain formation pressure and to increase the quantity of hydrocarbon recovered. Implementation of these techniques may require the drilling of additional wells within the field for material injection and/or the conversion of existing production wells to injection wells. Enhanced recovery techniques may also require the construction of material generation or storage facilities and of pipelines to carry the material to the injection wells (Appendix A).

Gas Lift

4.464 Gas lift involves the bubbling of a gas into the bottom of the wellbore to increase the buoyancy of the fluid column. The source of the gas may be at the upland treatment facility or at the wellhead.

4.465 Water Quality. Impacts from these activities would be the same as those described previously for the similar drilling and pipeline construction activities, assuming the construction of new facilities is required.

4.466 Hydrology. Impacts would be the same as those described previously for pipeline installation activities. Plugging and refilling of trenches is important after the pipelines are installed.

4.467 Wastewater Disposal. Activities and types of wastewater would not differ from those for other hydrocarbon production activities described previously.

4.468 Wetland Ecosystems. Wetland ecosystems probably would not be affected by the use of gas lift. If the gas source is placed at the treatment facility it is likely that the transport lines to the wells would have been installed when the gathering system was constructed. If not, the small diameter line required (4 inches or so) would probably be placed within the existing gathering system right-of-way. The effects of this construction would be similar to that described for gathering system construction. If the gas storage equipment is placed at the wellhead, it is likely that existing platforms would accommodate it.

4.469 Aquatic Ecosystems. Aquatic ecosystems would only be affected if a pipeline were installed separate from the gathering system. Effects of this would be similar to those described for gathering system construction.

4.470 Groundwater. There would be little, if any, impacts on groundwater resources through the use of a gas lift enhanced recovery system.

4.471 Air Emissions. Air emissions associated with enhanced recovery are shown in Table 4-3.

4.472 Noise. Gas lift methodology (American Petroleum Institute [API], 1976a) involves injecting pressurized gas. Associated noise would probably by negligible at the wellhead since pressurized gas is usually recycled from the onshore partial treatment plant if the well is reasonably close to shore. In the less likely event that on-location compression equipment is used, noise levels would be similar to air compressors (92-100 dB) and pumps (80-90 dB) listed by the New England River Basin Commission (1976) for oil refineries, gas plants, and the like previously described. On-site equipment may be more heavy duty, however, and produce higher noise levels.

4.473 Solid and Hazardous Wastes. Gas lift procedures for oil wells include injection of gases into the well to increase the buoyancy of the fluid column. This method may require the installation of gas supplies, compressors and pumping equipment. Propane, butane, and methane are used as solvents to mix with the

oil for easier displacement. Since this method may require additional land or dredged areas for pipelines, pump stations, and other facilities, solid waste volumes similar to those already discussed for drilling and gathering systems can be expected.

4.474 Socioeconomic Characteristics. If gas injection required installation of a new pipeline the requirements and effects would be the same as those described earlier in this chapter. Once a pipeline is operational few employees would be needed since the system is highly automated (Haney, 1983, personal communication).

Pumping

4.475 Oil can be forced up the well by pumping using sucker rods, hydraulic pumping or submersible pumps. This equipment would be installed at the wellhead.

4.476 Water Quality. No additional effects are anticipated beyond those discussed for site preparation and routine operations during the drilling phase.

4.477 Hydrology. No additional effects are anticipated beyond those discussed for site preparation and routine operations during the drilling phase.

4.478 Wetland Ecosystems. No additional wetland area would be affected by the installation and operation of pumping equipment. If a drilling platform exists at the site, pumping equipment would be placed on it. Any addition to a wellhead platform in a slip or river channel would not affect adjacent wetlands.

4.479 Aquatic Ecosystems. Aquatic ecosystems would be affected only slightly by platform construction at the wellhead, if required.

4.480 Groundwater. There would be no impacts on groundwater resources through the use of a pumping system for enhanced recovery.

4.481 Wastewater Disposal. No unique aspects of wastewater management would be evident for enhanced recovery via pumping.

4.482 Air Emissions. Air emissions associated with enhanced recovery are shown in Table 4-3.

4.483 Noise. During pumping a "pumping unit" is used to provide motion to a sucker-rod string connected to the downhole pump which forces reserves to the surface (American Petroleum Institute, 1976a). A pumping unit is powered by an electric or gas engine with a pumping capacity determined by the depth of the well.

4.484 Pumping noise is decreased if an electric power unit, as opposed to a gas power unit, is used. Electric motors associated with buildings, for example, emit up to approximately 100 dBA and diesel engines from about 90-110 dBA (Bolt, Benanek, and Newman, Inc., 1971). Pumping unit engines may be of higher horsepower and consequently may produce higher noise levels.

4.485 Solid and Hazardous Waste. Waste material generated by this alternative would be similar to that described for the gas lift alternative.

4.486 Socioeconomic Characteristics. If pumping were employed, equipment installation on the production platform would be necessary. The size and complexity of the equipment would determine the number of workers needed. In all likelihood the crew would be about the same size as an installation team described for well completion.

Material Injection

4.487 The recovery of oil can be enhanced by injecting materials into the formation. These materials could include water, solvents, treating chemicals, steam or gases. Material injection could be through existing production wells converted to injection wells and/or through new wells drilled for injection purposes. It is probable that the source for injected material would be constructed at the upland treatment facility.

4.488 Water Quality. Impacts from these activities would be the same as those described previously for drilling and pipeline construction activities.

4.489 Hydrology. No additional effects are anticipated beyond those discussed for site preparation and routine operations during the drilling phase.

4.490 Wetland Ecosystems. If new wells are drilled within the oil field for material injection, the effects on wetlands would be the same as those described for drilling, site preparation and operation. These effects include the loss of wetland area within canals, slips, board roads and ring levees, the alteration of wetlands under drilling platforms and trestle roads, and the reduction of biological productivity within pipeline corridors. Conversion of existing wells to injection wells would have no additional affects on wetlands since it is likely that conversion activities could be carried out on existing wellhead platforms or within existing canals and slips.

4.491 Aquatic Ecosystems. If new wells are drilled for injection, the effects on aquatic ecosystems would be the same as those described for drilling and pipeline river crossings. These effects include the destruction of benthic communities by canal construction and trenching for pipeline river crossings and the effect of turbidity resulting from these activities on aquatic organisms. New aquatic habitat would also be created within canals and slips in place of wetland habitat.

4.492 Wastewater Disposal. Other than any newly-utilized chemicals that are soluble in water, the management of wastewater would be no different from those described for well completion. Compatibility of the wastewaters with other wastewaters being treated at an upland site is an important consideration.

4.493 Groundwater. Potential for groundwater contamination is partially associated with those activities covered previously for drilling. However, chemical injection or fracturing methods may hold the most potential due to physical and chemical alterations of the formation (Beck et al., 1981). Beck et al. (1981) provide a listing of many of the different chemicals which may be used for enhanced recovery. The primary concern with these chemicals is the possible carcinogenic or mutagenic properties which may exist. Detailed understanding of the degradation of these chemicals does not exist. Additionally, a lack of concise knowledge of the extent of aquifers and injection zones as well as migration characteristics and natural discontinuities within the strata offers some doubts as to the ultimate disposition of chemicals injected for enhanced recovery.

4.494 From a physical point of view, fracturing as a method for enhanced recovery offers a greater possibility that restrictive layers above or below the oil formation may be breached. This effect could increase the potential for fluid contamination of any aquifers above or below the fractured formation. However, for the expected production zones in the Delta the distance between fresh water aquifers and the fracturing zones would probably minimize the potential for impacts. The fracturing process itself, if the method is hydraulic, produces great amounts of fracturing waters which must be disposed and which contain potentially hazardous materials.

4.495 Production of oil utilizing enhanced procedures generally increases the amount of brine which is removed and which must ultimately be disposed. In addition to their high chloride content, these brines may contain heavy metals, whose introduction into aquifers may then occur through the various pathways discussed previously (Beck et al., 1981).

4.496 Air Emissions. Air emissions associated with enhanced recovery are shown in Table 4-3.

4.497 Solid and Hazardous Wastes. The possible drilling of additional wells, the establishment of pumping stations, and the need for additional pipelines could result in the clearing of additional areas for these facilities. An associated increase in solid waste volume would result. The use of chemicals and solvents also poses the potential problem of spillage. Many of the materials utilized are able to be reclaimed.

4.498 Socioeconomic Characteristics. If new wells are drilled or equipment installed the labor requirements and effects described for the drilling phase would pertain.

Cultural Resources

4.499 The potential impacts to the cultural resources of the area due to production operations are similar to those impacts associated with drilling operations. Any production activity that produces surface disturbances has the potential for impacting archaeological sites. In production operations, these activities include the installation of a gathering line system and well drilling in previously undisturbed areas for enhanced recovery operations. However, one or more levels of cultural resources investigations would be required before such work proceeds.

Commercial Fisheries

4.500 It is not expected that waterway traffic or other activities associated with production operations would affect commercial fishing in the Delta. In certain gathering line cases where hydraulic dredging in a small channel uses a floating discharge pipe extending across the whole channel, such a waterway would be closed to other boat traffic including commercial fishing boats for the few days the channel is closed. However, due to the very low level of commercial fishing activity, the wide geographic distribution of boat landings, the vast number of waterway miles that could be fished, and the small number of cases where a waterway would be closed, it is not expected that boats involved in fishing activities would encounter such a waterway obstruction.

Spills of Toxic or Hazardous Material

4.501 During the hydrocarbon production phase, materials potentially damaging to the Delta environment could be spilled from several sources. These include the following:

- o Well servicing
- o Pipeline rupture
- o Well workover
- o Enhanced recovery

Well Servicing

4.502 Various solvents, chemicals and lubricants could be used in small quantities for normal day-to-day service of the well and gathering system. Spills of these materials could occur in small volumes. Environmental effects, if any, would be very localized. The effects of the loss of well control have been discussed for the drilling phase.

Pipeline Rupture

4.503 If a gathering system pipeline ruptured, the contents of the line of oil and/or gas between check valves could be released to the Delta environment. A rupture of an oil line within the wetland area at a low water stage would flow to the surface. Depending on the location, the spill may or may not spread beyond the vicinity of the break. If contained, vegetation and organisms affected by the spill pool would be killed. The effect of oil and gas released to water in the Delta would be the same as discussed for spills in the section on the drilling phase.

Well Workover

4.504 The activities undertaken during well workover would be similar to those during drilling and well completion. The kinds of accidents and effects that could occur have been described in the section on spills of toxic or hazardous materials for the drilling phase.

Enhanced Recovery

4.505 Enhanced recovery techniques utilize many gases and liquid chemicals in both continuous and batch injection techniques. The use of water or gases such as carbon dioxide, natural gas and air would have only a small effect on the environment if released accidently. Many different chemicals can also be used depending on the technique applied to the formation. These chemicals include petroleum solvents, alcohols, surfactants, anti-flocculants, mineral acids and polymers. Many of these would be used in batch amounts and would be brought to the injection site in barges or in trucks carried on barges. Many of these materials are toxic and could be harmful in the environment if spilled in large quantities or

achieved high concentratons in the water column. The site of the spill would partly determine effects. A spill in the natural channels would be diluted rapidly but material would be transported over a wide area. A spill at the slip end of a canal could be contained more easily but would reduce dilution.

Socioeconomic Effects of Material Spills

4.506 An accidental spill during the production phase could affect recreation and commercial and sport fishing in the area (see the discussion for spills in the drilling phase).

Accidental Release to the Atmosphere of Natural Gas Containing Hydrogen Sulfide

4.507 The classic treatment for a H_2S pipeline break was considered to be best modeled conservatively as a ground released condition under poor diffusion and dispersion conditions; i.e., usually under stable night-time, low wind speed conditions (Alberta Petroleum Industry-Government Environmental Committee, 1978 and 1979). Only recently have there been innovative approaches, one taken by Dames and Moore in the air permitting application on behalf of Mobil Oil Exploration and Producing Southeast, Inc. Five individual oil rigs were permitted under PSD regulations by the Alabama Department of Environmental Management. The discovery of H_2S in the Delta so far has been limited to a single case in the area where the emission concentration was 48 ppm. This is pointed out to illustrate the conservatism with which the MOEPSI analysis was accomplished. This single case is cited in the Movico Field filed by Superior Oil Eastern Division, and is found in State Oil and Gas Board State of Alabama Docket Number 9-17-8220 through 9-17-8226, dated September 17, 1982.

4.508 Mobil Oil Exploration and Producing Southeast, Inc. (1981a) states that a pipeline rupture could result in a release of up to 11 million cubic feet of gas. Three cases were investigated: 1) a complete break in the pipeline with all gas being emitted in the shortest period of time (an 18-inch break); 2) a break equal to approximately one-half of that (a 10-inch break); and 3) the worst case small leak that might not trigger alarms or detection equipment along the pipeline (a 1-inch break). In the first two cases, 11 million cubic feet of sour gas is released. Highest estimated ground level concentrations of hydrogen sulfide were calculated to be as follows:

1 percent probability (mg/m^3)

Distance	18-inch	10-inch	1-inch
0.2 km	117	154	136
0.4 km	41	53	86
1.0 km	21	43	39

4.509 A pipeline break probability on a 14-mile pipeline was estimated to be 0.00138 incidents/mile/yr.

4.510 In the accident analysis presented in those applications, a parametric and multiple iterative modeling approach was taken which concluded with the fact that the former ground level release assumption was too conservative. That application reasoned that a great quantity of methane gas would be simultaneously released, along with the heavier hydrogen sulfide gas.

4.511 The authors further assumed that this would cause an "elevated" release, or the gaseous "plume", to rise. This then permits a conclusion that concerns for evacuation of personnel need not be as elaborate as previously believed since concentrations downwind will be less at a given distance.

4.512 A new parametric computer analysis study was recently completed by Alberta Environment in Canada (Choukalos, 1980). The fundamental case was a pipeline of six inches in diameter and two miles in length under a pressure of 1000 psi in a Calgary climate. The program examines the risk of exceeding the instaneous concentration of 500 ppm. Other cases included concentrations, pipeline pressure, distance, weather, pipeline diameter, and wind conditions. The analysis concluded that no community development be permitted to be found in the 100 ppm concentration isopleth under the worst-case weather conditions. The model is based in part on actual pipeline rupture tests conducted in Canada.

4.513 A model has been developed which can handle most of the situations associated with pipeline or tank-storage failures (Oil and Gas Journal, 1983b). This Hazards Analysis model permits the examination of all types of pipeline failures as well as storage tank failures. It is versatile in that it treats three types of dispersion - one for very low wind speeds, a second for steady state conditions where density variations are not large, and a third whic is quite sophisticated. The latter model can handle three-dimensional, time-dependent gravity spreading and dispersion of dense clouds. Essentially, the output from this model is in concentration isopleths.

4.514 The modeling of an accident case should be examined on three bases, since it is critical to public safety. The first case would assume some multiple greater than 1.0 of the maximum potential "state-of-the-art" hydrogen sulfide gas release considered credible from an accident. The second case would combine this with the poorest diffusion conditions warranted for the area as determined from an examination of at least five years of "representative" weather data for the area. "Representative" weather data is sometimes difficult to find and it is even more difficult to determine the degree of fit of the data. Recent studies (Courtney, 1983b, 1983c) have shown that for planning purposes (not air quality permitting purposes) 3-hourly interval weather data is quite adequate. However, weather data are often taken only a few miles apart and are different due to local conditions of one kind or another. The only way data can be termed "representative" is if some data (usually 90 days or more) are taken at the site under simulated final site conditions. The third case would be to examine diffusion "special cases" such as "fumigation" and "split-level" releases to determine that, indeed, neither of the first two situations could be worse, that there should be a demonstration, either modeling or by field-test, and that the accident mode could not produce worse results than previously assumed.

4.515 There are reasons for this. The cognizant agency totally responsible for accidents is not always clearly identified. Another reason is that the micrometeorological wind structure and air circulations near a coastline are likely to be extremely complex and rapidly changing with diurnal variation. The modelling completed to date concerning a potential nearshore accident has not considered or dealt with this complexity which may well be more potentially dangerous to public safety than those cases which were considered. Certainly, cases of this nature need to be documented in the field, modeled, and found to be of less concern before the assumption can be made that a "standard" Pasquill Class F low wind speed event is indeed the worst case. This will require shoreline meteorological data.

Emergency Response to Hydrogen Sulfide Release and Pipeline Ruptures

4.516 Canadian literature (Atwell and Andrews, n.d.; Energy Resources Conservation Board, n.d.) and a recent paper presented at the Industrial Pollution Control Symposium (Secrest, 1983) all cite useful contents and procedures for emergency planning. The Canadian studies indicate that a plan should contain procedures for:

Locating and controlling a release;
Defining and isolating the hazard;

Emergency notification procedures;
Evacuation plans for residents and transients; and
Return from evacuation procedures.

4.517 An integral part of all procedures is the location of the 100 ppm H_2S isopleth and where it will be in the future. Some of this information is predetermined through simulation of weather and accident conditions.

4.518 Training programs and emergency drills are required. Plans are reviewed periodically for update and revision to today's conditions and knowledge. Secrest (1983) reports on an on-site emergency response system where a microcomputer is connected to an on-site weather tower to provide real-time calculations of concentrations downwind and their location using a mathematical dispersion model. Some plans also include a dial-up of telephone numbers of residents downwind of the accidental release, and a taped warning statement to ensure rapid dissemination of the accident conditions.

ABANDONMENT

4.519 If no commercially recoverable quantities of hydrocarbons are discovered after a well is drilled, the wellsite would be abandoned. Likewise, when the economically productive life of the field is over the field would be abandoned.

Well Sites

4.520 Wells would be plugged with cement and the surface casing cut off below the surface in accordance with Alabama State Oil and Gas Board regulations (Alabama State Oil and Gas Board, 1983). Well site equipment and platforms would be removed.

4.521 The most current Mobile District permit conditions require that canals and slips be refilled to the original contours with material from the adjacent storage piles, and if necessary, with clean material brought in by barge. Vegetation must be planted on the entire area and maintained for two years. Area formerly under platforms and within pipeline corridors would be allowed to revegetate naturally. Bridges, if any, used for pipeline river crossings would be removed and the area regraded.

4.522 Within aquatic ecosystems, channels would be refilled and foundation pads within waterways spread around or removed. Structures within waterways would also be removed.

Water Quality

4.523 Impacts to surface water due to these activities would be similar to the impacts caused during platform construction described previously. Canal and slip restoration is a requirement of abandonment in the Delta. As dredged material dries it shrinks and, depending upon the organic content, could lose over 85 percent of its original volume (Conner, et al., 1976). Therefore, it is not likely that the canal/slip can completely be restored to its original condition with the original dredge material. If the canal/slip was to be restored to its original contours, clean fill would have to be barged to the site. Placement of fill in the canal/slip would have the same types of impacts as described for dredging of the canal and slip; these are increased turbidity, lowered dissolved oxygen, and perhaps increased nutrients and trace metals in the canal. However if large diameter soils, such as sands are utilized then less turbidity would be generated than with most wetland topsoils.

4.523a Site restoration would eventually result in regaining wetlands lost during installation activities. Water quality benefits of the presence of wetlands (see Paragraph 4.59) would eventually be regained as well.

Hydrology

4.524 During the abandonment process, the necessary boats and barges would cause localized changes in water circulation. As slips and any canals are filled, local circulation within the river channel would return to the conditions evident prior to hydrocarbon development if the dredged material fills the canal or slip to the same elevations at the river bank as were evident prior to development. During flooding of the delta, flows of water across the wetland could be accelerated (as compared to pre-development conditions) if the slips and any canals are only partially re-filled.

4.525 For all site access alternatives, impacts on water circulation are dependent upon the ability of the disturbed Delta vegetation to recover as completely and as quickly as possible to pre-development conditions once abandonment activities are concluded.

Wetland Ecosystem

4.526 Wetland area that formerly occupied the canal, slip and adjacent dredged material storage areas would be recreated by the refilling of these areas. Areas formerly contained under platforms or trestle roads could potentially return to their original condition.

4.527 <u>Restoration of Canals and Slips</u>. Based on the requirements of the most recent drilling permit issued for the Delta, restoration of canals and slips constructed for the use of an inland drilling barge or for service vessel access to a drilling platform site would be accomplished by returning the stored dredged material to the canal and slip system beginning at the inland end. If compaction of the stored material has occurred so that the volume available is insufficient to fill the slip and canal completely, clean riverine sand would be brought in by barge to fill the canal and slip. In such cases, the riverine sand would be placed in such a way that the final surface layer would be the original material dredged from the canal or slip. Surface elevation of the filled system would be that of the adjacent wetland surface. The restored surface would be planted with appropriate species and the plantings maintained for two years.

4.528 Because only one canal in the Delta has been restored to date (September 1984), no data are available on the revegetation process that would take place. In the forested portion of the Delta it is likely, however, that some succession of vegetation types would occur leading to a climax forest similar to the adjacent system at that elevation and inundation frequency. Planting of climax tree species and suppression of other species for the first two years may allow establishment of these species, but once site maintenance ceases it is probable that shade-intolerant understory species would become dominant until a canopy of tree crowns forms (Wharton et al., 1982).

4.529 The speed at which a restored site in the forested Delta would recover is not currently known, but observations suggest that it could be less than 30 to 50 years, the possible rate of recovery of an unrestored dredged material disposal site in the Delta. Dredged material was placed on the wetland surface adjacent to the dredged channel connecting the Mobile and Tensaw Rivers (about one mile south of the Louisville and Nashville Railroad), which was constructed by the Corps of Engineers in 1950. One of the material deposition areas was visited on 23 February 1983. No readily apparent difference could be observed between the vegetation on the material deposition area and adjacent areas of similar elevation. A change in vegetation type with elevation was observed. Species found near the center of the deposition area, which was slightly higher than the natural elevation of the area, were typical of drier, less frequently flooded sites within the Delta.

4.530 Some factors may affect the revegetation of restored canals and slips. Because the soil material and structure within the restored area may be different than adjacent areas, the composition of the vegetation community that develops could be

somewhat different than adjacent areas. Also, since surface elevation, which determines inundation frequency, is an important determinant of vegetation type, variations of elevations within the restored area could determine what community ultimately develops.

4.531 In the southern treeless portion of the Delta, revegetation patterns are more difficult to predict. In this area, small differences in elevation may be more important than in the bottomland hardwood areas. Because of this, a mosaic of types of emergent vegetation could occur depending on the particular microrelief established within the restored area.

4.532 Revegetation of Areas Under Platforms and Trestle Roads. Removal of drilling platforms and trestle roads within the wetland area would allow revegetation to occur. If planting and maintaining vegetation is not required for the forested portion of the Delta, the site would probably exhibit a successional pattern typical of the logged sites in Delta. Recovery could occur within 30 years (see previous section on canals and slips). Recovery of sites in the non-forested wetlands of the southern Delta would probably occur within 5 years.

4.533 Soil compaction and disturbance by machinery during construction of a platform and trestle road could affect the recovery rate or species composition that occurs, however, since surface disruption can be long lasting in the forested areas of the Delta. For example, some swamp buggy tire track depressions from seismic surveying are still visible after four years, although vegetation within the tracks appears to be similar to adjacent areas (Workman, 1983, personal communication). Also visible in aerial photographs after 75 years are the tracks along which logs were dragged to a central loading point in Shipes Canal in the central Delta.

4.534 Effects of Restoration and Recovery. If recovery of affected wetland area is reasonably similar to the community structure typical of the Delta, then the wetlands values associated with these areas would be regained (see description of affected environment). The biological productivity of the restored areas would be less at first than adjacent areas and gradually increase as the climax state is reached.

Aquatic Ecosystems

4.535 Aquatic ecosystems that had developed within canals and slips would be lost and the area converted to wetlands once again. The aquatic area affected would be about 2 acres for slips and 2 acres per 1000 per feet of length for canals.

4.536 If restoration of any channels dredged through adjacent shallows is required, dredged material stored adjacent to the channel would be used to refill the channel. Because of dewatering, compaction, spreading and erosional loss, it is likely that the volume of material available would not be sufficient to refill the channel completely. Channel restoration activities would destroy the benthic community that had developed within the channel and on the adjacent dredged material storage areas. Recolonization of the restored area would probably be rapid with recovery probably occurring within 2 years. Benthic community structure could be somewhat different than adjacent areas if substrate differences are great. Refilled channels within the shallow southern bays of the Delta would be available once again for growth of submersed aquatic vegetation.

4.536 Refilling of canals, slips and channels, the spreading or removal of foundation pads in waterways and dismantling and removal of well site structures would result in turbidity similar to that which occurred during their construction. The potential effects of this turbidity has been discussed for construction of the canal and slip drilling alternative.

Upland Ecosystems

4.538 Upland vegetation that had developed on material storage piles adjacent to canals and slips would be destroyed and the area converted to wetlands. The area affected would be 2.5 acres for slips and 3.5 to 4 acres per 1000 feet of length for canals. No unique aspects of wastewater management would be evident except that quantities of sanitary wastewaters would vary in proportion to the number of personnel working and temporarily residing at the well site.

Groundwater

4.539 There is opportunity for impact on groundwater resources when wells are abandoned. If sufficient formation pressures still remain, fluids could be discharged to the surface and contaminate the adjacent groundwater as the fluids percolate into the surficial aquifer. To prevent the escape of formation fluids from abandoned wells, the State of Alabama requires notification of abandonment and delineates procedures to plug the well. The procedures require cement plugs to seal hydrocarbon-producing zones and fresh water zones. A cement plug is also required near the surface of the well. Class II wells must be sealed in the same manner to prevent migration of formation fluids within the abandoned well and to seal fresh water-bearing formations. Abandoned wells that have been improperly sealed are among the major causes of pollution to fresh water aquifers.

Air Emissions

4.540 Air emissions associated with abandonment are shown in Table 4-3.

Noise

4.541 Procedures used during well site abandonment include filling the well with inert fluid (e.g., drilling mud), plugging the well, and removing the surface wellhead and casing down to the required depth (usually 15 feet below grade). Wetlands well abandonment involves dismantling platforms and pilings and possibly backfilling of access canals and slips.

4.542 These activities involve cement pumping, hoisting of casing, welding, dismantling, truck hauling, and boat/truck/auto traffic. Noise levels for several of these, or similar functions, are listed in Appendix E. Backfilling may require construction equipment.

Solid and Hazardous Wastes

4.543 Waste material generated during this phase of hydrocarbon development is limited to unsalvageable construction materials. Canals and slips will be backfilled with stockpiled dredge material and/or new dredge material as needed.

Socioeconomic Characteristics

4.544 Abandonment of a Delta well site would involve dismantling equipment and the platform and restoring the canal and slip. It has been estimated that a crew about the size of the original dredging crew would be used to refill the area. Additionally, approved soil from other areas would be barged in. Once the area was properly filled, it would be replanted, and monitored. A local nursery could be involved with this activity, thus benefitting area business. The level of this beneficial effect would be minor. However, once a well is abandoned, a significant source of state and local revenues would be eliminated.

4.544a Assuming a value of $30, the loss in severance taxes (10 percent) could amount to $3 for each barrel of oil not produced. Another loss of $7.50 per barrel could result from the cessation of royalties collected. Abandonment of a gas well, valued at $3.45 per million BTU's could result in losses to the state of 34¢ in severance taxes and 86¢ in royalties for each 1,000 cubic feet not produced.

Navigation

4.545 The waterway traffic due to abandonment consists primarily of boats used to remove equipment and to support any required restoration efforts. For abandonment of a dry hole, a tug would return to the drill site to return the drill barge to its port of origin or to transport it to its next work site. For abandonment at a field no longer economically productive, a barge would be used to remove the production platform and associated well site equipment. In the case of a drilling barge or production platform located in a river channel, the removal of the drill barge or production platform and the mooring piles would remove a potential hazard to navigation. For a modular fixed platform, a tug with barges would be used to remove the drilling rig or production sub assemblies. A crew boat or boats would continue to shuttle workers between the drill site work area and a local boat landing.

4.546 At any site where a canal and slip or a slip only had been dredged, a tug would deliver a barge-mounted dredge for restoration efforts. Due to the high water content of the original material, the stockpiled dredged material will have less volume due to dewatering and compaction during storage. Because of this, restoration of the total area dredged will require the transport of several barge loads of material. The amount of extra fill material required and, therefore, the number of barges required would be site specific. In certain areas in the Delta, clean river sediment from an area adjacent to the canal could be used and thus reduce the number of barge trips. There would also be several small boat trips by Federal, State, and company officials checking on completed restoration efforts.

Pipelines

4.547 Pipelines to be abandoned would be drained, flushed and left in place. Vegetation management activities within pipeline corridors would cease.

Water Quality

4.548 Any above-ground structures that may be removed, such as pumping stations, could disrupt sediments near a canal, slip or river channel. The description of water quality effects from sediment disruption described for abandonment of well sites would apply here if such disruption occurs near a water body. Effects of pipeline flushing fluids are discussed under wastewater disposal.

Hydrology

4.549 As the pipeline corridor slowly fills in a natural manner with wetland vegetation, water movement along the corridor

would return to pre-development conditions (i.e., lower water velocities during wetland flooding periods). Any sediment associated with the water would more easily be deposited onto the wetland as natural vegetation returns.

Wetland Ecosystem

4.550 Within the forested wetlands of the Delta, vegetation succession would occur resulting in the redevelopment of a community similar to adjacent areas. The area affected would be about 1 acre per 1000 feet of corridor length. Observation of revegetated dredged material disposal piles in the Delta suggest that this could occur within 30 years. Factors that could alter the succession process include the extent of soil disturbance and soil compaction that remain and the final elevation of soil within the corridor. Those wetland values lost during the period of maintenance of the pipeline corridor would be regained as succession toward a community type similar to adjacent areas occurred.

4.551 Within the southern Delta where emergent vegetation predominates, abandonment would have no new effect. Recovery of these corridors would have occurred soon after pipeline construction. Because no woody vegetation occurs there (if the corridor was carefully restored), no corridor vegetation maintenance would have been required.

Groundwater

4.552 Pipeline abandonment usually entails only emptying of the produced fluids. The pipes themselves are normally abandoned in place. In addition, any restoration of sites to their pre-development natural condition will aid in restoring normal surface water and groundwater interactions.

Air Emissions

4.553 Air emissions associated with abandonment are shown in Table 4-3.

Noise

4.554 Although the pipeline is not removed, surface facilities such as compressor stations may be. Noise associated with such activities involves basic construction noise as well as boat or vehicular transport and loading noise. All-terrain vehicles may be required in wetland Delta areas. Some site restoration may be conducted as appropriate.

Solid and Hazardous Wastes

4.555 Waste material generated during this phase of hydrocarbon development is limited to unsalvageable construction materials. Pipelines will be drained of product (captured), plugged and left in place.

Wastewater Disposal

4.556 Wastewater resulting from the draining and flushing of pipelines would be collected at a barge or at an upland location, treated and then disposed properly according to state discharge requirements.

Socioeconomic Characteristics

4.557 As previously described, the maintenance operation of a pipeline would at most provide employment for a small crew. This same crew could be involved in flushing and cleaning a pipeline to be left in the ground. No significant socioeconomic effects would be likely from this activity.

CHAPTER 5

ENVIRONMENTAL CONSEQUENCES OF UNIT ACTIONS IN MOBILE BAY AND MISSISSIPPI SOUND

INTRODUCTION

5.1 Potential environmental loadings and generic environmental effects associated with hydrocarbon exploration and production unit actions in the shallow coastal estuaries of Mobile Bay and Mississippi Sound are discussed in this chapter. A unit action is defined as a group of activities or sequence of events that occur together to complete a particular portion of a phase of hydrocarbon exploration and production. Some examples of unit actions are site preparation for a drilling alternative, well completion, gathering system construction, and gas treatment facility operation.

5.2 The analysis is presented according to the four major phases of activities that take place. Reasonable alternatives available for carrying out the necessary activities within each phase have been considered.

- Geophysical Exploration Phase

  Seismic survey boats
  Marsh buggies in salt marshes

- Drilling Phase

  Inland drilling barge
  Jackup drilling rig
  Submersible drilling rig
  Fixed drilling platform

- Production Phase

  Well completion
  Platform installation
  Gathering system construction
  Normal operations of wells and pipelines
  Well workover

- Abandonment Phase

  Well sites
  Pipelines

Spills of toxic and hazardous materials and the accidental release to the atmosphere of natural gas containing hydrogen sulfide are also considered for the drilling and production phase. Although land subsidence has occurred at various locations around the world due to production from oil and gas fields (Holzer and Bluntzer, 1984), it has not been a factor in the areas under consideration in this study nor would it be expected to be a factor for production from the deep formations under consideration (Menk, 1984b). Reduction of underground pressures has in some instances resulted in surface subsidence. In this region, no subsidence would be expected because of the depth of occurrence, stratigraphy, and rock strength or competence of the Smackover-Norphlet reservoirs. Rock units from 5,000 feet to as much as 21-22,000 feet consist of consolidated, competent limestone, shales, and sandstones. Fluid or gas withdrawal would not result in subsidence, since the reservoir fabric and the overburden are not supported by liquids or gas (U.S. Army Corps of Engineers, 1980).

5.3 Only those activities that would occur within the boundaries of Mobile Bay, Mississippi Sound and adjacent wetlands are considered in this chapter. Associated activities such as construction and operation of a treatment facility that would take place on adjacent upland areas are discussed in Chapter 7. A summary of loadings and generic effects is given in tabular form in Chapter 2.

Approach to Analysis

5.4 Environmental loadings resulting from exploration and production activities have been determined for each unit action and the generic environmental consequences of each activity discussed. For example, the amount of benthic habitat disturbed by pipeline construction has been calculated and the generic effects of the disturbance of benthic communities discussed. However, the significance of this effect on the Mobile Bay or Mississippi Sound ecosystem would depend on the total area altered at any time. This analysis is made in Chapter 8 (Environmental Consequences of Regional Resource Development Scenarios). The unit action analyses of Chapter 5 serve as a basis for the cumulative effects determined in Chapter 8.

Organization of Chapter

5.5 The discussion of environmental loadings and generic effects in Mobile Bay and Mississippi Sound has been organized around the four major activity phases of geophysical exploration, drilling, production and abandonment, which constitutes the major

sections of the chapter. The details on loadings and generic effects associated with activities for each major phase are presented. These analyses are divided into site preparation, routine operations and accidents.

GEOPHYSICAL EXPLORATION

5.6 Collection of seismic data in the Bay and Sound is a modified form of deep water offshore operations. Operations are generally conducted from a shallow-water boat towing a long cable with hydrophones to detect the reflected seismic signal. The seismic signal is produced by an air gun in which compressed air is suddenly released. An alternative to a towed cable is the use of separate floating hydrophones that use radio transmitters to send seismic data to the ship's recording equipment. However, such hydrophones must be relocated individually after each shot. In the marshes around the Bay and Sound, seismic data collection would be done with a marsh buggy, as in the Delta.

Shallow-Water Seismic Survey Boat

5.7 In the Bay and Sound, seismic surveys would generally be conducted with a shallow-draft boat towing a mile-long seismic cable containing hydrophones to detect the reflected acoustic signal. Although dynamite has been used in the past as an acoustic source for shallow waters, today the commonly used seismic source is the air gun. An air gun is a chamber that is filled with compressed air which, when suddenly released, produces the seismic signal. Typically, several airguns are trailed behind the survey boat, each gun connected by hoses to an air compressor. The air guns are generally of different sizes, with various spacing and small time delays in their detonation so that the acoustic signal from each blends together to make one large signal (Coffeen, 1978).

5.8 During operations, the survey boat is continuously underway at slow speed (about 2 to 2 1/2 miles per hour) and the air guns are detonated every 6 to 10 seconds. To avoid interference with waterway traffic in the area, a shallow draft support boat is generally used as a chase boat. The chase boat follows the end of the seismic cable to keep track of any ships on a course that would take them over the path of the cable and to inform such ships on radio or by visual contact that a seismic cable tow is underway.

Water Quality

5.9 Some solids could be resuspended in the Bay and Sound due to boat movements and due to seismic exploration activities. However, exploration is quite short-term and localized, so

resuspension of solids would oc : for less than 1 hour after the activity ceases. Unavoidable spills of small quantities of refined products would occur, most of which would evaporate or dissolve in less than 24 hours.

Hydrology

5.10 Just as solids would be resuspended, water velocities would increase within the vicinity of the exploration activities and boat movements. Any changes in water velocities would dissipate as the activity ceases or moves to another location.

Aquatic Ecosystems

5.11 The operations of the survey boat and the chase boat are basically the same as other similar sized craft and would not produce any significant effects on aquatic organisms. Air gun operations do not produce the massive energy pulse that unconfined explosives produce. Air gun operations are not known to damage marine life (Gilbert, 1983).

Wastewater Disposal

5.12 All sanitary and containable boat wastes would be discharged on-site in accordance with U.S. Coast Guard regulations. Treatment prior to discharge is required for boats with installed toilet facilities.

Groundwater

5.13 Geophysical exploration in open waters has minimal impact on groundwater resources. Surface disturbances are minor and any possible pollutants spilled or discharged as a result of this activity would be diluted by surrounding waters and would not impact any aquifer.

Air Emissions

5.14 Table 5-1 indicates the vehicular emission strategy used in this geographical area. Exploration is shown at an activity level of (2) and of 180 days duration per rig.

5.15 Table 5-1 also indicates the definition of activity level (1) for both helicopters and boats. Typical emissions from these vehicles are shown in Table 5-2. All data were derived from U.S. Environmental Protection Agency (1978). Conversion to activity level (2) is achieved by doubling the emissions. Conversion to 180 days of activity is achieved by multiplying defined emissions by 180/100.

TABLE 5-1

SCHEMATIC OF METHOD FOR ANALYZING POTENTIAL VEHICULAR EMISSIONS IN MOBILE BAY AND MISSISSIPPI SOUND

Resource Extraction Phase	Activity Level Factor	Activity Duration (Days)
GEOPHYSICAL EXPLORATION	2	180
DRILLING	3	180
PRODUCTION		
Well Completion	2	30
Gathering Systems	2	100
Normal Operations	2	300
Well Workover	2	60
Enhanced Recovery	3	90
Abandonment	1	30

TABLE 5-2

TYPICAL VEHICLE EMISSIONS ASSOCIATED WITH HYDROCARBON DEVELOPMENT ACTIVITIES IN MOBILE BAY AND MISSISSIPPI SOUND

	Emissions (Tons Per Year)				
Vehicle	Carbon Monoxide (CO)	Hydro-Carbons (HC)	Nitrogen Dioxide (NOX)	Sulfur Dioxide (SO2)	Total Suspended Particulates (TSP)
Helicopter	3.10	0.29	0.31	0.095	0.131
Pull Boat	0.01602	0.00108	0.00180	0.000072	0.00036

Note: See Appendix G, page 2-49 for the method of annual emissions calculations.

Solid and Hazardous Waste

5.16 The somewhat greater reliance on barges, boats, and marsh buggies for exploration activities in shallow water areas alleviates many of the impacts associated with the Delta area. However, the potential for overboard spillage and dumping, fuel and lubricant leakage, and accidents which could result in water quality impacts exists, but no major volumes of any type of solid waste are generated during these activities.

Socioeconomic Characteristics

5.17 Shallow-water seismic crews stay on board 24 hours a day. Operations are conducted during daylight, for 12 to 14 hour shifts during a 14 day tour. The boats generally come to shore only between contracts, or to take on supplies and fuel. Local purchases for goods, services and repairs benefit onshore businesses; however, there is usually only a limited opportunity to employ locals for 2 or 3 positions out of a crew size of 15 to 16 people.

5.18 Generally, geophysical surveys have no significant onshore siting or staging requirements. The vessels require berthing space and are similar in size and needs to a commercial fishing boat (Clark et al., 1978).

Navigation

5.19 A seismic vessel towing a mile long seismic cable could affect ship traffic if precautions were not taken. The seismic cable is designed to float two feet above the bottom and in shallow water a boat crossing the cable could snag the cable with its propeller. However, standard operations for seismic operations include a chase boat following the cable-end tail buoy to warn other boats that a cable tow is in progress. If an approaching boat does not respond to radio calls, the chase boat can move to intercept the other boat (Hoff and Chmelik, 1982). In addition, operations are usually planned to avoid the heavy weekend waterway traffic and it is standard practice to include as part of the crew, local watermen who know the area and also know boat operations in the area, particularly fishing boat patterns (Young, 1983. Personal communication).

Marsh Buggies in Salt Marshes

5.20 Geophysical exploration in any of the salt marshes around Mobile Bay and Mississippi Sound would be performed in a manner similar to such activities in the Delta. Shot hole drills mounted on a tracked marsh buggy would be used to drill the shot hole and a line of geophones designed for marsh conditions would be

used to detect the seismic signals. The shot holes would be drilled to 150 to 200 feet and explosives would be used for the energy sources.

Water Quality

5.21 Turbulence from a marsh buggy would resuspend sediment from the salt marsh along the path which the buggy travels. Because water velocities are sluggish (usually less than 0.1 foot per second), the suspended sediment would settle very near its original location.

5.22 Some small amounts of refined fuels and oils would unavoidably be spilled from a marsh buggy. Most of these refined fuels and oils would evaporate or dissolve in less than 24 hours.

Hydrology

5.23 For short time periods, travel of a buggy through a salt marsh creates travel paths where vegetation is temporarily disturbed. Along these shallow travel paths, water velocities could be higher than in the surrounding wetland particularly if the travel path is connected to the Bay or Sound and affected by tidal forces. This impact on water velocities would subside as the marsh vegetation fills in the buggy travel path.

Wetland Area Altered

5.24 Typically, a marsh buggy would disturb an 8 to 9 foot wide section as it moved along a particular seismic exploration line. The area disturbed by the marsh buggy would be about 1 acre per mile of survey line. The tracks on the buggy would crush the marsh grass and cause some compaction of underlying material. If extensive, ruts can remain for years and drainage patterns could be altered. Soil compaction, if excessive, could reduce productivity and alter the vegetation composition (Langley et al., 1978).

Drilling Fluids

5.25 The drilling muds bentonite or moutmirillonite or additives used in shot hole drilling are typically simple compounds that are added to water to increase its viscosity enough to lubricate the drill bit and to carry cuttings out of the drill hole. The amount of additive used is generally on the order of 1 part of additive to 200 parts of water.

Wastewater Disposal

5.26 All sanitary and containable buggy wastes would be discharged in the same manner as for shallow-water seismic survey boats.

Groundwater

5.27 The potential effects on groundwater from a marsh buggy mounted shothole drill would be the same as that described for a shothole drill in the Mobile Delta (in Chapter 4).

Noise

5.28 A temporary increae in noise will occur due to the operation of vehicles in the marsh areas. This noise will be more noticeable due to its nearness to sensitive receptors such as homes and beaches. Noise levels similar to light trucks (72-95 dBA at 50 ft.) are expected.

Socioeconomic Characteristics

5.29 The principal requirements from this activity are described in Chapter 4. However, different locations for staging areas would be used for nearshore environments of the Bay and Sound. The use of staging areas or crew meeting points result in short term, minimal traffic increases from commuters and trucks.

DRILLING

5.30 After a geological formation that could potentially contain hydrocarbons is identified by geophysical exploration, a well must be drilled to determine if hydrocarbons occur there. If commercially recoverable quantities are found, additional wells are usually drilled to recover the maximum quantity of the resource in the most efficient and cost-effective manner consistent with the regulations of the Alabama and Mississippi Oil and Gas Boards. In general, a surface drilling location directly over the geological target (vertical hole) is preferred whenever possible for the initial well (wildcat well) because subsurface geological conditions that can affect drilling are unknown. Subsequent drilling may include directionally drilled wells (slant drilling) to reach subsurface locations lateral to the surface drilling site.

5.31 Five drilling alternatives are possible in Mobile Bay and Mississippi Sound:

- o Inland drilling barge
- o Jackup rig
- o Submersible rig
- o Fixed drilling platform
- o Directional drilling from uplands

Each of the first three alternatives have operational water depth limits without requiring channel dredging for access. Standard draft drilling barges can be used in water as shallow as 6 feet. A newly available shallow draft design could operate in water only 3 feet deep. For a fixed platform, depths greater than 7 to 10 feet would probably be required for access of construction vessels. A jackup rig or submersible drilling rig could be used in water as shallow as about 12 feet if specially modified, but most available rigs must be used in waters deeper than 15 feet. The use of directional drilling from an upland location would be of limited usefulness in the region because of the current limits of the technology and the lack of shoreline sites for drilling.

5.32 Drilling activities or potential accidents associated with drilling that can affect the Mobile Bay and Mississippi Sound region include the following:

- o Preparation of the drilling site for placement of the drill rig.
- o Normal operation of the drilling site resulting in air emissions, noise and vessel traffic.
- o Operation of a service base.
- o Expenditures in the local economy for wages, goods and services.
- o Waste disposal.
- o Accidental spills of harmful materials.
- o Accidental release of natural gas containing hydrogen sulfide.

The alterations associated with site preparation and routine operation of each drilling alternative are discussed below. The effects of accidents are discussed at the end of the Drilling section. Service bases are discussed in Chapter 7. A summary of environmental loadings and generic effects is presented in tabular form in Chapter 2.

Standard Inland Drilling Barge

5.33 A standard inland drilling barge could be used in most of Mobile Bay and Mississippi Sound where water depths are between about 8 and 15 feet. Operation in water shallower than about 8 feet would require dredging of an access channel. A typical site plan for using an inland barge rig is shown in Figure 5-1.

Site Preparation

5.34 When preparing a site for the standard draft drilling barge in open water, shell or other material may be used to provide a solid foundation on which to rest the barge. Steel sheeting and pilings may be placed around the barge site as a breakwater for protection. Additional piling clusters would be placed around the barge for mooring of service vessels, and as a spill control measure.

5.35 Water Quality. Increases in turbidity may result from placement of the shell pad, driving of piles and sheeting, and propwash. These sediments should settle out of the water column rapidly and not be detectable except in the immediate vicinity (TechCon, Inc., 1980). Sheet piling was installed for a recent well in lower Mobile Bay during high winds and currents of approximately two knots with no measurable turbidity increase (TechCon, Inc., 1980).

5.36 If dredging is required, a bucket dredge or a hydraulic dredge could be used. Spoil could be placed alongside of the trench or stored in a barge for ultimate disposal in the deeper waters of the Gulf of Mexico or a diked disposal area on land. Turbidity plumes downstream of a typical bucket operation may extend from 1,600 feet at the bottom to 1,000 feet at the surface with a maximum concentration of 500 mg/l suspended solids and an average concentration of 100 mg/l (Barnard, 1978). The concentrations would decrease rapidly downstream from the discharge and laterally away from the center line of the channel.

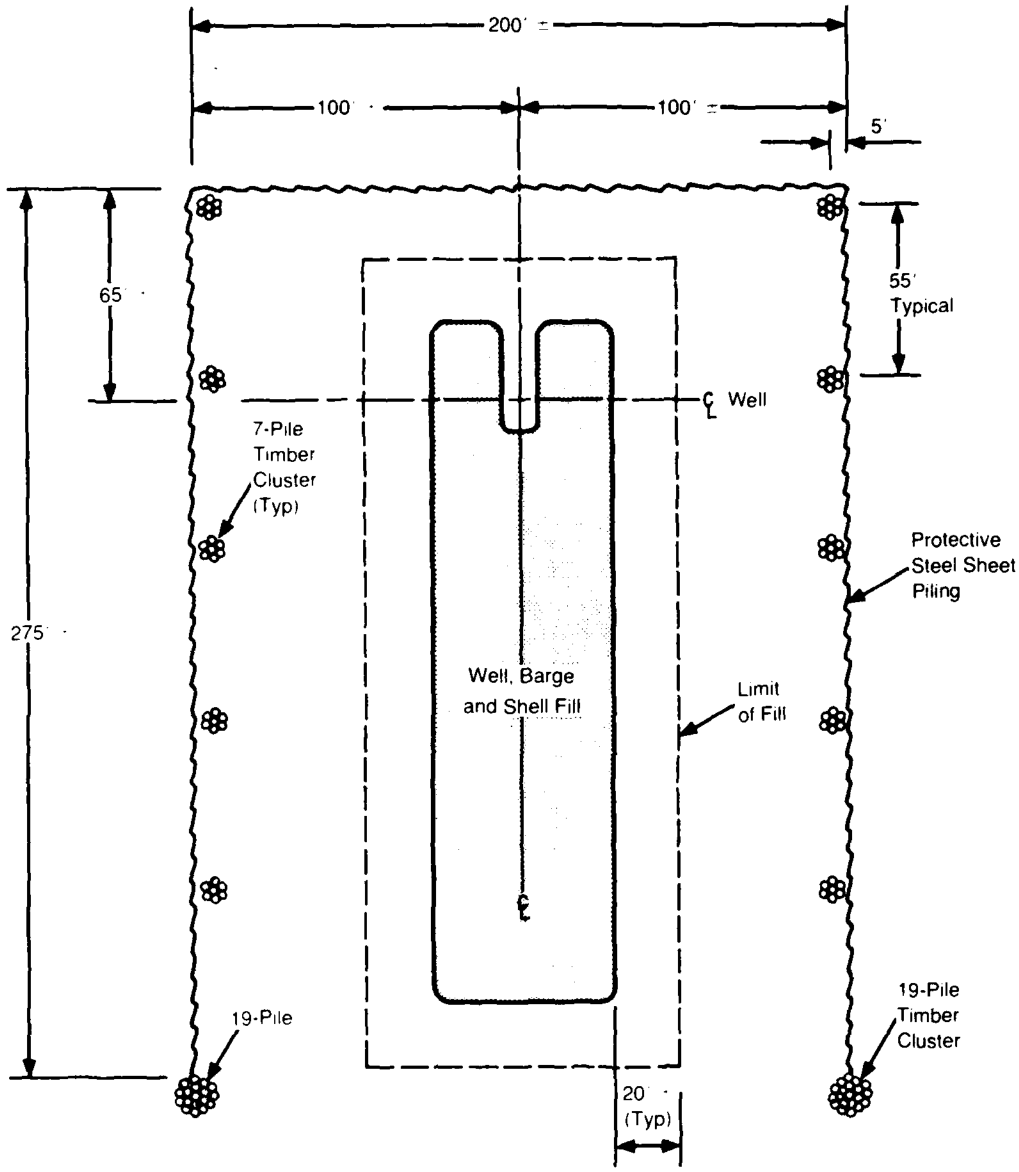


FIGURE 5-1
POSSIBLE SITE PLAN FOR USE OF AN INLAND DRILLING BARGE IN MOBILE BAY AND MISSISSIPPI SOUND

5.37 The "head" of a hydraulic dredge mechanically loosens bottom sediments and the scarified sediments are pumped through a suction pipe and discharge pipe to the disposal area. Suspended solid concentrations within three meters of the head are highly variable but may be as high as a few tens of grams per liter and decrease exponentially to the water surface (Barnard, 1978). At distances of a few hundred meters away from the head, near-bottom suspended solids concentrations may be a few hundred milligrams per liter.

5.38 If the dredged material is discharged into open waters either alongside of the channel or in deeper waters of the Gulf of Mexico the vast majority of sediments would settle rapidly and accumulate under the discharge point as a fluid sediment mound. No plume was detectable two to three hours after discharge of dredged material from the Gulfport Ship Channel (Marky and Putnam, 1976). Concentrations of the fluid sediment may be in the range of 10 to 500 g/l.

5.39 Open water disposal of dredged materials can affect short-term water quality if the dredged sediments contain high levels of pesticides, PCBs, or ammonia. Harmful levels of metals probably are not resuspended in the water column based on conditions needed to force such resuspension during laboratory experiments. No significant changes in heavy metal concentrations have been observed as a result of dredging in the project area, with the exception of brief increases in zinc and iron (U.S. Army Corps of Engineers, Mobile District 1975a). Oil and grease compounds, hydrocarbons, pesticides, PCBs, metals, and phosphates are rapidly sorbed onto resuspended particles.

5.40 Studies by the U.S. Corps of Engineers on sediment resuspension in Mobile Bay show that nutrient-related constitutents such as ammonia nitrogen, Kjeldahl nitrogen, dissolved phosphorous, and total organic carbon are the most likely constituents to be released to the water column during dredging (U.S. Army Corps of Engineers, Mobile District 1975a). Concentrations of these constituents would vary with distance from the dredging operation and with time. Dissolved oxygen levels are reduced near dredged areas in Mobile Bay due to sediment oxygen demand. Within sediment flows along the Bay bottom, depressed oxygen levels have been observed to extend 800 to 1,700 feet from dredging operations (U.S. Environmental Protection Agency, et al., 1973). However, dissolved oxygen levels at the water surface and at mid-depth are observed to be only slightly depressed.

5.41 The U.S. Army Corps of Engineers has stated, as the result of a 1968 dredging surveillance program, that weather has a more significant effect on sediment transport than dredging operations. No data were seen to either support or refute such a judgment. Marky and Putnam (1976) also reported that effects of wind and current on suspended solids and turbidity levels were greater than effects of dredging of the Gulfport Ship Channel.

5.42 Hydrology. Currents adjacent to the inland drilling barge could be altered somewhat because of the barge and dredging modifications. Current eddies would form as waters pass by the barge and any access channel. Such eddies would be more evident during periods of high inflow from upstream rivers and at the mid-point of tidal cycles when tidal velocities are often highest. However, effects of a drilling barge and access channel on water movements would not be evident more than a few hundred feet from the barge or channel. In addition, no changes in water levels due to a barge are anticipated.

5.43 Estuarine Ecosystems. The principal effects of site preparation on estuarine ecosystems would be the loss of benthic habitat, the creation of new fouling community habitat and the generation of turbidity. About 0.3 to 0.7 acres of benthic habitat would be buried under shell pads depending on depth. About 0.5 acres of fouling community habitat would be created on the steel sheets used for site protection.

5.44 Benthic area that could be buried by shell pads include soft bottom invertebrate assemblages, oyster reefs, seagrass beds and nursery and spawning areas. The soft bottom benthic community consists of organisms attached to or resting on the bottom or living in the bottom sediments. In Mobile Bay and Mississippi Sound, the benthic community is diverse and includes worms, clams, oysters, shrimp and demersal fishes. This assemblage of estuarine organisms is important in recycling nutrients and providing food for higher tropic levels including commercially valuable populations, such as oysters and shrimp.

5.45 Placement of a drilling barge in a seagrass bed would result in the loss of an especially valuable community type. Beds are more extensive in Mississippi Sound than in Mobile Bay (see Chapter 3). These plant communities and their associated algal species are highly productive and provide excellent habitat for many marine organisms, especially juvenile shrimp, crabs and fish (Bittaker and Iverson, 1976; Fry and Parker, 1979; Mann, 1973; Sheridan and Livingston, 1983) and also serve as a food source for migratory waterfowl. Current guidelines in Mississippi discourage

placement of a drilling rig in a seagrass bed or in a buffer zone of one mile around a seagrass bed. In Alabama, no drilling rig can be placed closer than one-half mile to the shoreline. Most seagrass areas remaining in Alabama occur within one-half mile of shore.

5.46 Many of the aquatic organisms within the study area have complex life cycles. While the adult form of a species may be found in one type of habitat, spawning may occur in a different type of habitat, and juvenile forms may require special areas that offer protection from predators and an abundance of small food items (nursery areas). Where species are motile, spawning and nursery areas are actively selected, based on environmental attributes such as salinity, temperature, depth, current, bottom type and the presence of cover (e.g., aquatic vegetation) (Springer and Woodburn, 1960; Perlmutter, 1961; M.C. Baker, 1971). Individual species tend to have distinctive patterns of habitat selection. However, in general, shallow zones and areas of submerged vegetation have been identified as key spawning and nursery grounds for many of the species found within the study area (Lyles, 1975). An adequate supply of these special habitats is necessary for the maintenance of the resident aquatic community.

5.47 Fouling communities consisting of small invertebrates and algae would develop on the steel sheets around the barge. This community is a food source for fish and invertebrates adapted to feed on it and would replace some of the ecosystem functions of the benthic community buried under the shell pad.

5.48 Turbidity would result from placement of the shell pad and propwash of construction vessels. This turbidity would be very localized and of short duration, having little effect beyond the immediate vicinity of the construction site.

5.49 Wastewater Disposal. Management of sanitary wastewaters and other liquid wastes is discussed under routine operations.

5.50 Groundwater. Site preparation activities for drilling locations in the Bay or Sound would include no element that could produce impacts on groundwater resources.

5.51 Air Emissions. Air emissions associated with drilling in Mobile Bay and Mississippi Sound are shown in Table 5-3.

5.52 Noise. Site preparation would be negligible in an open water location in Mobile Bay or Mississippi Sound. For inshore Bay and Sound areas, preparations would be similar to descriptions for a Mobile River Delta inland drilling rig. For either an inland or offshore location, the drilling barge would require towing by tug

TABLE 5-3

EMISSIONS GENERATED BY RIG AND VEHICLE OPERATIONS
DURING HYDROCARBON RESOURCE DEVELOPMENT
IN MOBILE BAY AND MISSISSIPPI SOUND

Resource Extraction Phase	Activity Level Factor	Emissions (Tons Per Year)					Correction Factor
		Carbon Monoxide (CO)	Hydro-carbons (HC)	Nitrogen Dioxide (NOX)	Sulfur Dioxide (SO2)	Total Suspended Particulates (TSP)	
GEOPHYSICAL EXPLORATION[a]	2	6.232	0.582	0.6236	0.190	0.263	—
DRILLING[a]	3	9.350	0.873	0.935	0.287	0.394	—
PRODUCTION[a]							
Well Completion	2	1.039	0.096	0.103	0.032	0.044	30/180
Gathering Systems	2	3.462	0.319	0.344	0.106	0.146	100/180
Normal Operations	2	3.462	0.319	0.344	0.106	0.146	100/180
Well Workover	2	2.088	0.192	0.208	0.063	0.086	60/180
Enhanced Recovery	3	4.674	0.431	0.465	0.143	1.970	90/180
Abandonment	1	0.519	0.479	0.0156	0.016	0.218	30/180
RIG OPERATION[b]		162.000	2.800	390.000	26.000	13.400	—

[a]Emissions tabulated are those generated by helicopters and pull boats. See Table 5-2.

[b]Note: All phases of rig operations were considered in assessing these emissions. In short, emissions from the rig during activities such as well completion and well workover are included here and not in the columns covering well workover or well completion. See Appendix G, page 2-36.

boat. Noise levels may be similar to data in Chapter 4 for channel tug boats. Pilings may also be set once the barge is maneuvered on site. Pile drivers produce 101 dBA at 50 feet.

5.53 Solid and Hazardous Wastes. Where inland drilling barges are located in offshore open water areas, solid waste will consist primarily of construction trash, garbage, and sanitary wastes. All such wastes would be disposed of by barge at approved onshore facilities. In marsh area access channels may be required, however the dredge material will remain on site for reclamation use.

5.54 Socioeconomic Characteristics. Site preparation in the Bay and Sound requires fewer procedures than in the Delta. The first activity is soil boring to determine the strength of the soil relative to the weight of the rig. Normally this work is contracted out; a crew no larger than a dozen people would be needed (Joynson, 1983, personal communication). The results of the soil survey are used to determine the foundation requiements and the type of rig. The bottom directly under the barge rig could require excavation and placement of a shell pad. This work is contracted out and area firms have the opportunity to bid. The potential results from these activities in addition to rig installation would be the same as those described in Chapter 4.

5.55 Navigation. In order to provide a level of safety for shipping using the main navigation channels in the area, restrictive zones have been established parallel to the designated navigation channels (U.S. Department of Transportation, 1982c, 33 CFR 166.200). Similar restrictions have been established for certain anchorage areas. These safety fairways and anchorages are established to control the erection of structures in order to provide safe approaches through oil fields to entrances t the major ports along the Gulf Coast. The erection of structures is not permitted (33 CFR 166.200) in designated fairways since such structures would constitute obstructions to navigation. The erection of structures within a designated anchorage area may be permitted but subject to the provision that the center of any new structure be not less than two nautical miles from the center of any existing structure. Additionally, in a drilling or production complex, associated structures must be as close together as practicable having due consideration for the safety factors involved.

5.56 Site preparation activities for an inland drilling barge in the Bay or in the Sound would involve additional waterway traffic to and from the drill site and would involve construction activities in the vicinity of the site. The additional waterway traffic would include a barge-mounted crane and pile driver, tug with the drill barge, supply barges with tugs and crew boars. A tug or tugs would bring the drill barge from its port of origin or possibly from a

nearby drilling site and the tug(s) would return to its port of origin. Approximately 3 to 5 supply barges would be used to deliver the shell for the drill barge foundation (about 1700 cubic yards), the timber piles for piling clusters (from 100 to 200 piles depending on drill site configuration), and sheet steel piling to provide a protective slip for the drill site (about 750 linear feet). A barge-mounted crane and pile driver would be used to emplace the timber piles and the sheet steel piling. In shallower portions of the Bay or the Sound, the barge-mounted dredge would be needed to dredge an access channel to the drill site. Crew boat traffic would depend on operations schedules: daylight hours only or 24-hours a day. During the four to six weeks work time, the crew boat could make two to three round trips per day between the work area and the local port being used as a staging area. The crew boats used in the Bay and the Sound (for both site preparation and routine operations on all rig types) would be the larger, open water crew boats, not the smaller type used in the Delta. In addition, some smaller craft could occasionally be used for inspection or checking of site preparation activities. The waterway traffic increase would not result in a significant increase over the current variable traffic levels.

5.57 During site preparation activities, an area 300 to 400 feet on a side would be closed to any ship or boat traffic due to the drill site activities and the presence of tugs, barges and crew boats. However, as previously discussed, none of these activities would be allowed in any of the area's navigation channels or safety fairways - the areas of greatest concentration for waterborne traffic.

Routine Operation

5.58 Routine operation would be those activities required to drill the well. All liquid and solid wastes would be collected in waste barges moored adjacent to the drilling rig and disposed of in an on-land disposal site approved for such wastes. Activity would be self-contained with personnel living on the drilling rig. Personnel and materials would be brought to the site by boat and barge and, occasionally, helicopter.

5.59 Water Quality. TechCon, Inc. (1980) has monitored environmental effects caused by recent drilling operations in Mobile Bay. Water temperatures, dissolved oxygen, and salinity all exhibited normal seasonal trends. Visual observations at the well site showed no evidence of a turbidity plume associated with activities at the well. However, localized turbidity may be caused by scour around the sheet pile bulkhead and propwash from support vessels (U.S. Army Corps of Engineers, 1980). Infrared values of

oil and grease at the well site were less than 0.05 mg/l and gravimetric values were less than 0.5 mg/l during drilling. During installation of creosote pilings, infrared values of oil and grease were measured in the range of 0.06 to 0.44 mg/l. Methane and total dissolve low molecular weight hydrocarbons (DLMWH) near the well site exhibited normal seasonal fluctuations, with one exception . Methane and DLMWH valves reached 3 to 10 times the seasonal maximum during testing of gas flow and when the pipe was pulled and the plugs placed to suspend operation. Methane concentrations were highest when the pipe was being pulled. After the pipe was pulled, methane levels returned to normal. This evidence suggests that high values were due to drilling activities; however, no control samples were taken at sites removed from the vicinity the well. Pre- and post-operation analysis of sediment parameters revealed that, except for the effects caused by Hurricane Frederic, sediment composition was similar throughout the recent drilling phase.

5.60 Hydrology. The presence of drilling rigs in Mobile Bay or Mississippi Sound creates local obstacles to water movement. The system-wide impact of any single rig would not be significant in the wide open area of Mobile Bay or Mississippi Sound. Local scouring around the pilings and sheet metal could be expected from wave action in the shallow waters.

5.61 Changes in bathymetry caused by dredging can affect surface water quality and hydrology. Previous dredging activities have definitely affected Mobile Bay. It is well documented that the navigation channels in Mobile Bay have altered the salinity regime of the Bay by allowing a salt wedge from the Gulf of Mexico to move up into the Bay and even into the Mobile River. The effects of the channels on water circulation are not as well understood, but it has been argued that the spoil piles on the sides of the channels have blocked exchange between the eastern and western sides of Mobil Bay. Oyster shell mining in Mobile Bay has left depressions where bottom waters reportedly stagnate and become low in dissolved oxygen. The impacts of an access channel would not be expected to be as severe as those of the navigation channels, or even the mining or borrow depression, for several reasons:

- Physically, an access channel is much smaller (seven feet deep instead of 40; hundreds or a few thousand feet long instead of tens of miles).

- The access channel starts and ends in the same body of water, unlike navigation channels that may run from fresh river water to Gulf seawater.

- The access channels will not connect to a navigation channel, so the salt wedge will not move into them unless it has spilled out of the channels and is moving across the entire Mobile Bay bottom.

- The access channel is in shallow water that is usually well mixed by winds and tides.

  The access channel will not be hydrologically isolated pockets like the mining or borrow areas, because one end (where the bottom naturally reaches seven feet deep) will have the same bottom elevation as the surrounding open bottom. With this open connection and natural vertical mixing in shallow waters, the formation of stagnant bottom waters with low dissolved oxygen is less likely.

- If a suitable upland disposal site is not available, open-water disposal of dredged material in the Gulf of Mexico would avoid spoil banks lining the access channels and hindering circulation.

5.62 Estuarine Ecosystems. Turbidity at the drilling site would result from propwash of service vessels. The area affected would vary but might be about the same (0.3 to 0.7 acres) as the area required for the shell pad. No effect would be likely beyond the immediate area around the rig.

5.63 Benthic area would be buried under the foundation pad or drilling barge hull for the duration of the drilling period, so that the area would be lost for biological production and as spawning and feeding habitat. Burial of seagrasses or oyster reef area would result in the loss of especially valuable community types because of the limited extent of these communities in the area and their ecological and commercial importance to the estuarine ecosystem and the regional economy. This loss would continue for several weeks if only one shallow well is drilled to several years if several deep wells are drilled with the barge from the same location. Little effect beyond the immediate vicinity of the rig is likely (Tech Con, 1980).

5.64 Wastewater Disposal. Discharge of oil or wastes from offshore drilling platforms is generally prohibited in both Alabama and Mississippi. Well operators may not pollute land or water or damage the aquatic life of the water or allow extraneous matter to

enter and damage any mineral- or water-bearing formation. The no-discharge for well sites rule within the State of Alabama was clearly stated in a consensus decision between the Alabama Department of Conservation, what is now the Alabama Department of Environmental Management, and the State of Alabama Oil and Gas Board. This decision was based on a settlement agreement with Mobil Oil and applies (with some variations) to discharges from any hydrocarbon exploration and production activity to state waters (Cooner, 1983).

5.65 Wastewater from well sites may be disposed of by injecting the water into an approved subsurface formation, transporting the water back to shore for disposal in an approved manner or discharging into the state waters offshore provided the water quality meets criteria established by appropriate regulatory agencies and is approved by the Oil and Gas Board. Most probably, wastewaters would be transported to upland facilities for treatment and disposal. Curbs, gutters, and drains must be constructed in all deck areas to collect contaminants, or drip pans must be placed under equipment to collect and transport dripping oil. A sump would automatically maintain the oil at a level sufficient to prevent discharge of oil into the waters. Spilled oil cannot be allowed to flow into the wellhead area.

5.66 All wastewaters transported to an upland treatment facility need to be compatible with that treatment facility. If the oils, waste fuels, and other chemicals disrupt treatment of sanitary wastewaters, separate pre-treatment of the oils, fuels, and other chemicals may be required.

5.67 Groundwater. Drilling activities in estuarine waters of Mississippi and Alabama are subject to regulations applicable to offshore activities. As indicated in Chapter 3, casing requirements are somewhat different than for onshore drilling but general considerations for the protection of groundwater sources still prevail. The potential for groundwater pollution exists as stated previously for the Delta region (Chapter 4).

5.68 Air Emissions. Air emissions associated with these activities are shown in Table 5-3.

5.69 Noise. Drilling noise from inland drilling barge activities would be comparable to noise levels for an inland drilling barge in the Mobile River Delta area. For offshore drilling, however, the noise attenuation distance would be greater than for inland areas due to lack of vegetation and physical barriers. Noise from vessels (Chapter 4) for waste removal and supply transport would also be less attenuated. Other sources, such

as marine signals, would be present intermittently. A Class C foghorn, for example, has a specified minimum audible range of 0.5 miles (U.S. Army Corps of Engineers, Mobile, 1980). The drilling barge would also sound various signals during poor visibility.

5.70 Solid and Hazardous Wastes. Routine drilling operations will not vary significantly from Delta or shallow water locations in the volumes or types of solid waste produced. All of the drilling alternatives which could be used in shallow water locations would still require the use of drilling muds and cements and would produce waste streams of drill cuttings, cement, produced water, sanitary wastes, and incidental trash. Under the zero discharge regulations mandated by both Alabama and Mississippi law, all wastes are collected in barges for approved disposal onshore. The only potential differences in waste volume and characteristics from those previously described are the drilling depths (which may result in greater waste volumes) and the higher probability of using saltwater-based mud systems.

5.71 Socioeconomic Characteristics. The personnel requirements, sequence of shifts and nature of auxiliary activities associated with an inland drilling barge in the Delta hold true for such an operation in the Bay or Sound. There is little interaction between the crew and local community since the workers live on the barge during their tours. Most noticeable activity takes place at the staging areas where supplies and crews are centralized for subsequent transport to the rig. Waterfront areas along the coast would be used to stage operations.

5.72 A drilling operation in Mobile Bay or Mississippi Sound is more accessible to the well developed offshore service network located in Texas, Louisiana and Mississippi, than is a Delta operation. Supplies and equipment could be transported directly from Louisiana for instance, depending on the material, transportation time and cost, and the location of an existing staging ground. Because the services industry is so close, a staging base does not have to be as complete as one would in an area far from services and supplies. Economics and time are predominant factors in logistical decisions made by operators.

5.73 Staging areas currently in use for drilling operations in the Bay and Sound include Bayou La Batre and Dauphin Island for one operator and an area near the State Docks in Mobile by another. In coastal Mississippi, Pascagoula is a base location for operations in the Federal OCS. However, any of the area's ports (Biloxi, Gulfport and Bay St. Louis) could be used.

5.74 Navigation. Waterway traffic due to routine operations would include tugs with mud or supply barges, crew boats, and small craft. The transport of waste drilling fluid and cuttings and the delivery of supplies would require approximately 1 barge trip every other day. During later stages this could diminish to 2 or 3 trips every two weeks. Waste drilling fluid would be delivered to a Gulf Coast treatment and disposal site and supplies would be delivered from the Gulf Coast area or the Mobile area. The tug moving the empty waste barges back to the drill station would also deliver supplies such as cement or drilling mud. Although the crew changes once a week, the crew boat would make additional trips between the drilling location and a local port staging area for supplies. As many as 3 trips per day can be made by the crewboat. The typical fleet of service craft can include 3 tugs, 8 waste barges, 5 deck or cargo barges, and 2 crew boats. The area occupied by the drilling barge and its sheet steel piling would continue to be closed to navigation.

Jackup and Submersible Drilling Rigs

5.75 A jackup or submersible drilling rig could be used in parts of Mobile Bay and Mississippi Sound where water depths are greater than about 12-15 feet. Depths of 12 to 19 feet occur in the southern portion of Mississippi Sound from the western end of Dauphin Island on the east to the vicinity of Cat Island on the west. In Mobile Bay, depths greater than 12 feet occur only in the vicinity of the mouth of the Bay. Most deep inlet areas are contained within the navigation safety fairways of the Gulfport, Biloxi, Pascagoula and Mobile ship channels. Both jackup and submersible drilling rigs have been used near the mouth of Mobile Bay.

5.76 A jackup or submersible rig would be floated to the site and temporarily anchored at the desired location. On a jackup rig, the legs would be lowered to the bottom and would penetrate the sediment to a depth that would depend on sediment characteristics. On a submersible rig, the hull would be flooded until the structure rests on the bottom. Pilings for mooring of vessels would be placed adjacent to the rig (Figure 5-2).

5.77 The rig would be serviced by boat, barge and, occasionally, helicopter. All liquid and solid waste would be collected in barges and disposed of in an on-land location approved for such purposes.

Site Preparation

5.78 Site preparation consists only of soil sampling by boring and the driving of piles for mooring facilities.

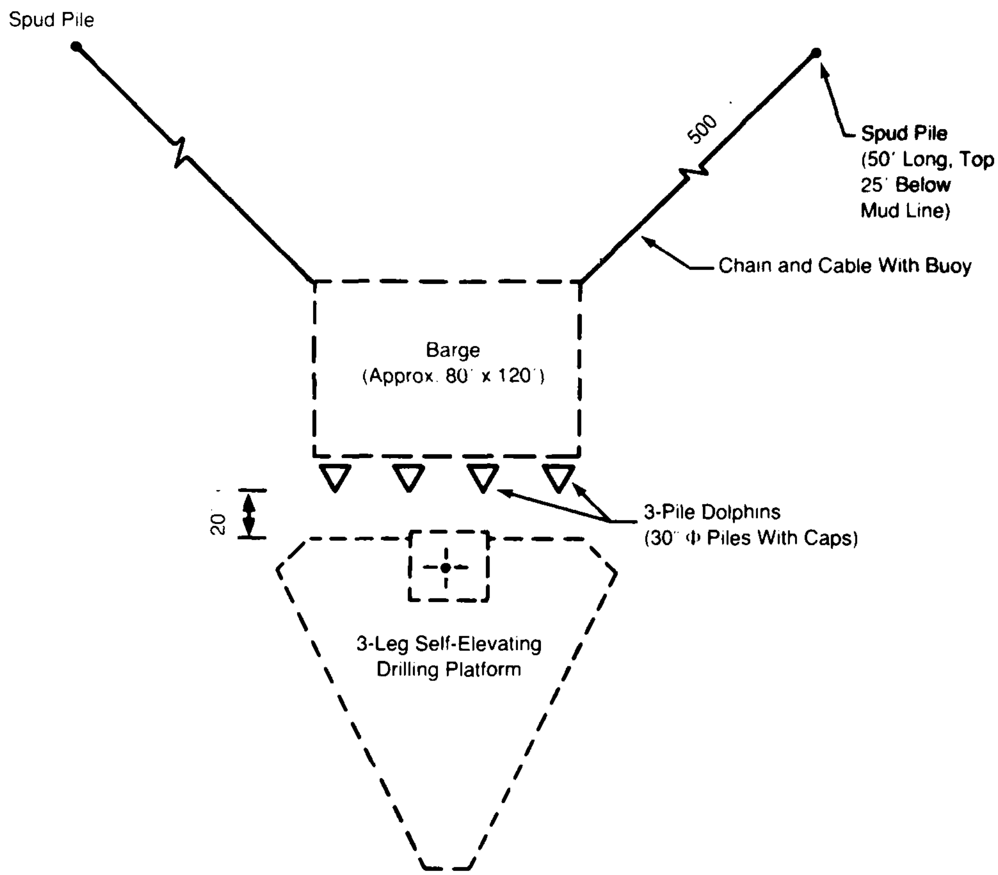


FIGURE 5-2
POSSIBLE SITE PLAN FOR USE OF A JACKUP OR SUBMERSIBLE DRILLING RIG IN MOBILE BAY, MISSISSIPPI SOUND OR THE GULF OF MEXICO

5.79 Water Quality. Minor increases in turbidity would result from site preparation activities. The resuspended sediments should settle out of the water column rapidly and not be detectable except in the immediate vicinity (TechCon, Inc., 1980).

5.80 Hydrology. Circulation within the Bay or Sound adjacent to the rig, access channel and paths for barges and boats would be altered. Eddies would form near the rig and access channel; eddies due to the access channel would probably only be evident in bottom waters. The extent of eddies would be the same as discussed for the inland drilling barge alternative. Water levels would not be altered.

5.81 Estuarine Ecosystems. Benthic ecosystems would be disturbed by the penetration of the sediment by the legs of the jackup rig. The area affected would vary with each rig but would beabout 0.2 acres. Area covered by the hull of a submersible rig would be 0.4 to 0.7 acres.

5.82 The turbidity resulting from pile driving and propwash would be localized. Turbidity resulting from jackup leg placement would be of short duration. It is unlikely that any effect would occur beyond the immediate vicinity of these operations.

5.83 Wastewater Disposal. Management of sanitary wastewaters and other liquid wastes is discussed under routine operations.

5.84 Groundwater. Site preparation activities for drilling locations in the Bay or Sound would include no element that could produce impacts on groundwater resources.

5.85 Air Emissions. Air emissions associated with drilling are shown in Table 5-3.

5.86 Noise. Construction preparations would involve towing the jack-up or submersible rig on location. Crewboats and supply carriers would shuttle people and heavy equipment such as cranes (see Chapter 4). Transport helicopters may also be used (70-90 dB at 1000 feet: New England River Basin Commission, 1976). Onshore staging areas would be noisy due to boat traffic and supply distribution activities.

5.87 Solid and Hazardous Wastes. Site preparation for this alternative will not generate substantial amounts of wastes. Dredging is restricted to placement of a shell pad, if necessary. A limited amount of construction wastes would be barged to shore for disposal at an approved site.

5.88 Socioeconomic Characteristics. The essential differences between the preparation and installation for a jackup or submersible rig and an inland barge are that the soil boring is deeper, no foundation is required, and an extra tug might be necessary to tow the rig on site (Johnson, 1983. Personal communication). The effects from the boring would be the same, no matter which rig was used. However, by removing the need for dredging and foundation installation, the opportunity for local firms to participate in site preparation would be reduced. Pile driving for mooring structures would still be needed; local firms could perform this work. Additionally, the use of an extra tug could benefit local employment for two or three people if a local firm were hired.

5.89 Navigation. Waterway traffic for a jackup or submersible drilling rig would be less than that for an inland drilling barge. No shell is required for a pad nor is a protective slip required. A barge-mounted crane and pile driver would be used to drive pilings for barge and crew boat mooring use during operations. Crew boats would be used on a daily basis for the pile driving crew. Two or more tugs would be used to deliver and maneuver the jackup or submersible rig. Some small craft traffic could be expected for site inspection trips. An area 200 to 250 feet on a side would be closed to navigation in setting up the drilling area.

Routine Operation

5.90 Routine operations would be those activities required to drill the well. All liquid and solid wastes would be collected in barges moored adjacent to the drilling rig and disposed of in an on-land disposal site approved for such wastes. The activity would be a self-contained operation with personnel living on the drilling rig. Personnel and materials would be brought to the location by barge, boat and, occasionally, helicopter.

5.91 Water Quality. Impacts to surface water quality and hydrology during routine operations would be similar to those described for a drilling barge.

5.92 Hydrology. Alterations to water circulation would be the same as those discussed for site preparation. No noticeable changes in water levels due to a jack-up rig or any related activities are anticipated.

5.93 Estuarine Ecosystems. The 0.2 acres of benthic habitat disturbed by the jackup legs would be recolonized partially. Scour around the leg structure would probably prevent complete recovery.

All area under the submersible hull (about 0.5 acres) would be lost as productive habitat while the rig remained at the location. Alteration or burial of seagrass or oyster reef area would result in the loss of especially value community types because of the limited extent of these communities in the area and their ecological and commercial importance to the estuarine ecosystem and the regional economy. This loss could continue for several weeks if only one shallow well is drilled, to several years if several deep wells are drilled with the same rig at the same location. Effects beyond the immediate area of the rig are unlikely (Tech Con, 1980).

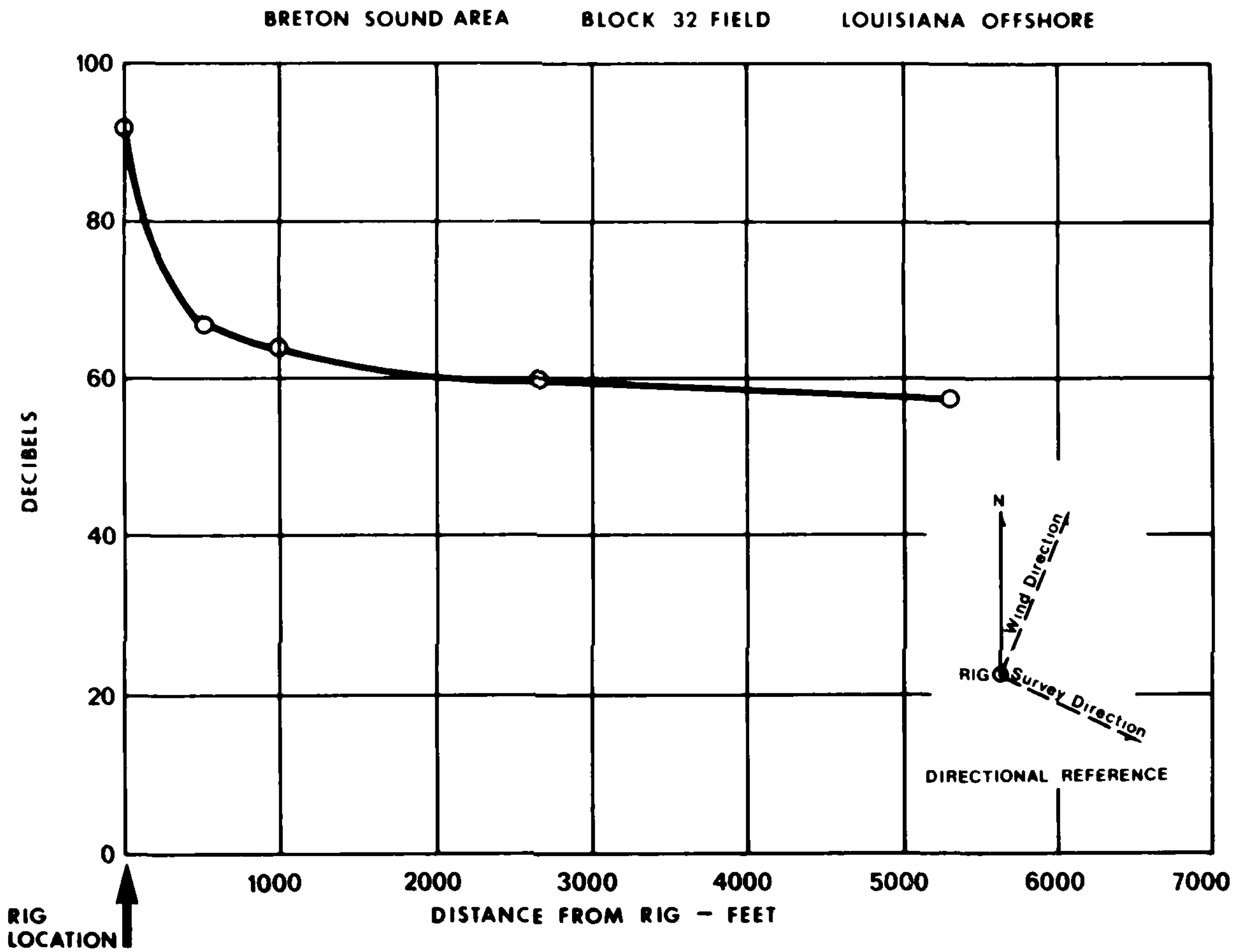
5.94 Wastewater Disposal. Management of sanitary wastewaters and other liquid wastes would be the same as for the inland drilling barge and all other drilling alternatives for the Bay and Sound. Wastewaters from well sites would be stored in barges and periodically hauled to a sewer line or directly to a wastewater treatment plant for treatment and disposal. Wastewaters from marine vessels would be discharged in accordance with U.S. Coast Guard regulations. Impacts of accidental spills are discussed elsewhere.

5.95 Groundwater. The potential impacts from routine operations of a jack-up or submersible rig would be the same as those described above for an inland drill barge.

5.96 Air Emissions. Air emissions associated with these activities are shown in Table 5-3.

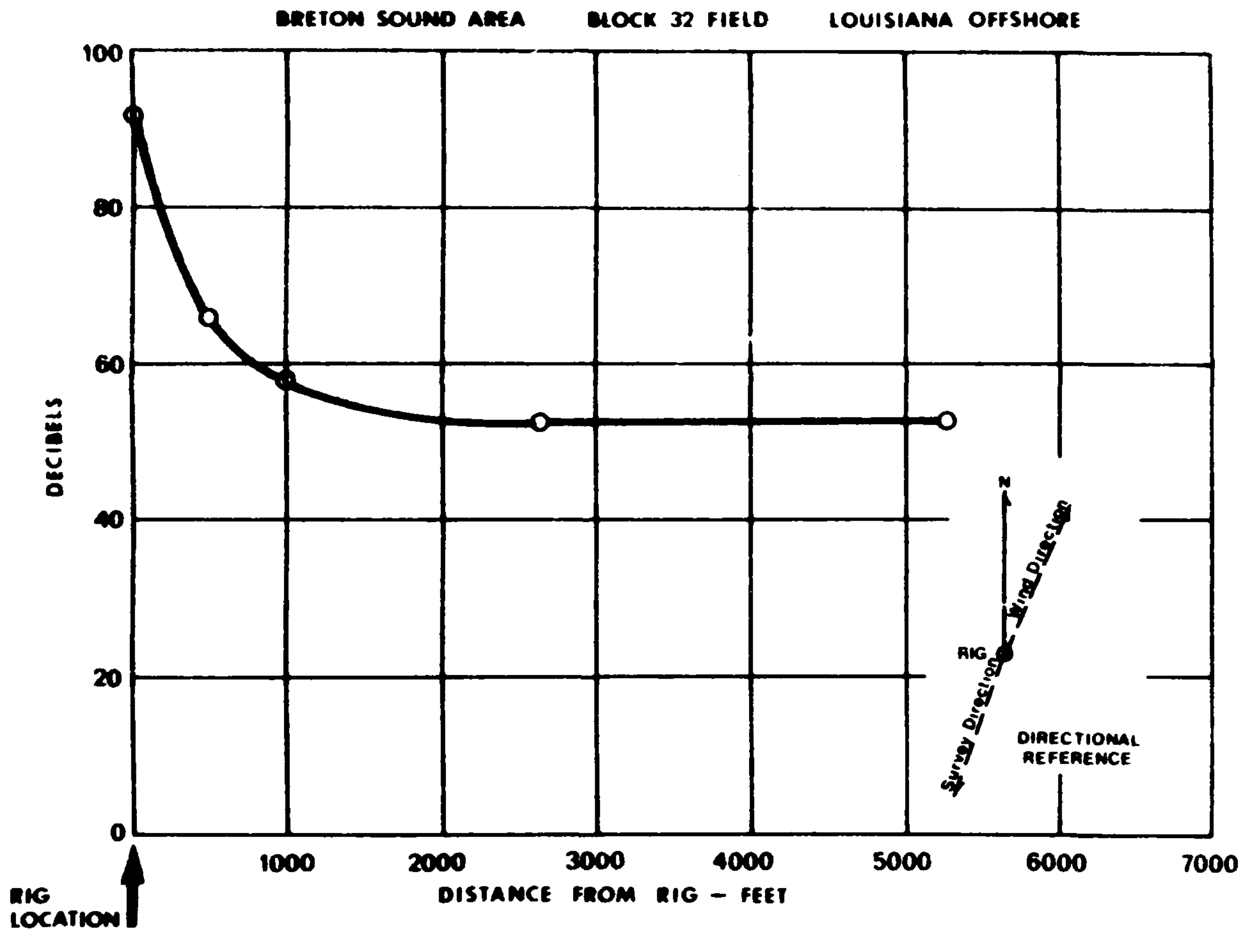
5.97 Noise. Noise levels generated by an operating drilling platform in the Gulf of Mexico offshore of Louisiana (Block 32 Field, Breton Sound Area) were recorded for Mobil Oil Corporation by Coastal Ecosystems Management, Inc. (1974). The noise levels should be typical of this kind of rig. As depicted in Figures 5-3 through 5-5, data were taken at southeasterly (Figure 5-3), southwesterly (Figure 5-4), and northeasterly (Figure 5-5) directions from the drilling platform for a distance of one mile. Interpretation of the graphs indicates that noise levels near the rig were approximately 92 dB, and were less than 70 dB at approximately 500 feet in all three directions. Noise levels were near 60 dB or less at 2000 feet in all directions, with noise readings taken in the southwesterly direction having leveled off, and data from the other two directions still declining. Ambient noise due to water motion and seagulls was estimated as being approximately 56 dB (Coastal Ecosystems Management, Inc., 1974).

5.98 Several oil and gas environmental impact documents have included noise data from offshore rigs (U.S. Army Corps of Engineers, 1980; 1982b; 1982a). Data involve proposed wells in



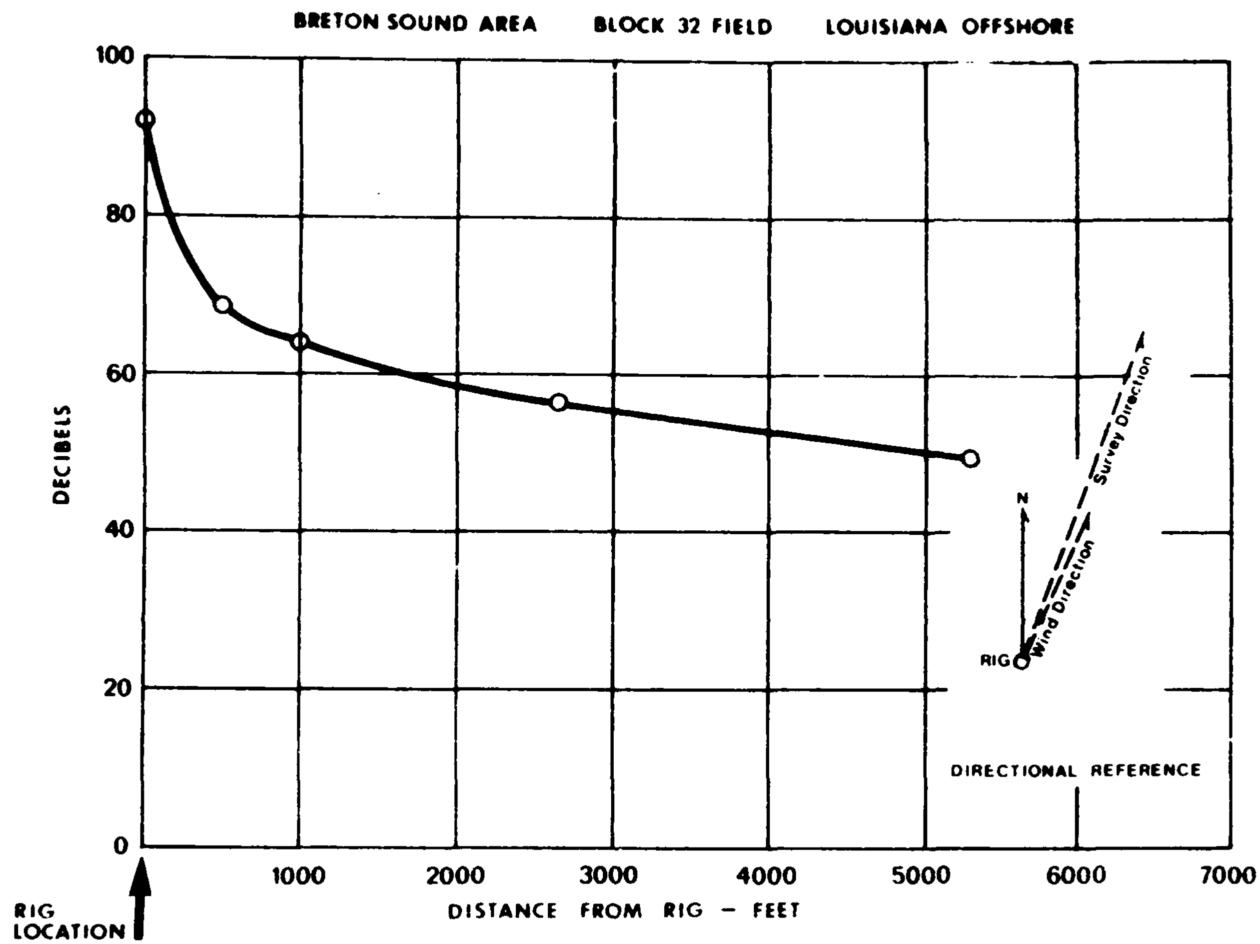
Source: Coastal Ecosystems Management, Inc. 1974.

FIGURE 5-3
NOISE LEVEL MEASUREMENTS TAKEN AT VARIOUS DISTANCES SOUTHEAST OF A DRILLING RIG OPERATING OFFSHORE LOUISIANA



Source: Coastal Ecosystems Management, Inc. 1974.

FIGURE 5-4
NOISE LEVEL MEASUREMENTS TAKEN AT VARIOUS DISTANCES SOUTHWEST OF A DRILLING RIG OPERATING OFFSHORE LOUISIANA



Source: Coastal Ecosystems Management, Inc., 1974

FIGURE 5-5
NOISE LEVEL MEASUREMENTS TAKEN AT VARIOUS DISTANCES NORTHEAST OF A DRILLING RIG OPERATING OFFSHORE LOUISIANA

leased tracts of Alabama coastal waters, particularly relative to noise impacts on Dauphin Island and the Fort Morgan peninsula area from a given well site location and noise attenuation site-to-shore distance. Tracts 76, 77, 94, and 95 were evaluated by the U.S. Army Corps of Engineers, Mobile District (1980a; 1982b). Exploratory/appraisal well sites were within 0.6 to 2.0 miles from the nearest shore. The nearest well (Site IV-1), approximately 3,200 feet from shore in Block 95, was expected to produce an L_{dn} of 64 dB (L_{eq} of 58 dB) on shore. Another site in Block 94, approximately 0.7 miles from shore, was expected to produce an L_{dn} of 61 dB at the shore.

5.99 More distant drilling sites were expected to emit noise levels 6 to 12 dB less at the Dauphin Island and Fort Morgan receptor shore areas. Drilling multiple wells, as opposed to single wells, at different blocks was expected to increase the noise level only slightly, from an L_{eq} of 58 to 59 dB at any given shore point. By comparison, ambient noise levels measured on Dauphin Island (Coastal Ecosystems Management Inc., 1974) were between 52 and 65 dB (L_{dn} of 58 to 71 dB) during light breaking waves (surf breaking noise not included). For a maximum drilling noise of an L_{eq} of 59 dB (L_{dn} of 65 dB), drilling noise activities would be masked by a similar ambient level of an L_{dn} of 65 dB or above, which would result in only a slight increase in the overall noise level. A drilling noise level of an L_{dn} of 65 dB would be more noticeable, however, for ambient levels below an L_{dn} of 60 dB.

5.100 Several other tracts in the region were also reviewed by the U.S. Army Corps of Engineers, Mobile District (1982b). For exploratory wells within leased Tracts 62, 63, 111, 112, 113, 115, 116 and 132, well site locations were specified for Tracts 112 and 113 and would be 20,000 feet or more from Dauphin Island. Drilling noise at these sites was expected to attenuate to 8 dB at the shore. This level would be below ambient levels during periods of light breaking waves (L_{eq} of 52 to 65 dB) and below calm ambient without manmade noises (L_{eq} of 30 dB). The midpoints of Tracts 115 and 116, the closest midpoints to shore for the remaining tracts without specified well locations, would be within a minimum of 15,000 feet from the Fort Morgan peninsula shore area. Cumulative drilling noise from two hypothetical well sites at these midpoints was expected to produce 23 dB at the nearest shore, which is below the calm ambient level. Hypothetical wells located in Tracts 115 and 116 at the closest possible points to shore (closer than midpoints) were expected to produce 37 dB on shore, which would be below ambient and 7 dB above calm ambient. Exploratory wells in leased Tract 89 would be as close as 2,800 feet from shore. Although no predicted noise data were presented for this site and distance from shore, one well at the midpoint of each of Tracts 89,

90, 71 and 72 were expected to cumulatively produce a noise level as high as 60 dB near shore. This would be similar to ambient, but 30 dB above calm ambient. Finally, leased Tract 52 is a minimum of 11,000 feet from the Baldwin County shoreline. Drilling at this distance was expected to produce noise of 31 dB at the shore, which is below ambient and comparable to calm ambient.

5.101 These expected shoreline noise levels suggest that drilling rig noise would typically not seriously impact shore areas for the site-to-shore distances evaluated, relative to ambient levels with light breaking waves. However, some expected noise levels do exceed calm ambient levels and noise propagation may be increased (or decreased) during certain atmospheric conditions (see Chapter 3). In addition, drilling rig operations that may be far offshore and not appreciably impact the nearest shore, would be "plainly audible" within a 0.25-mile radius to crewboat or fishing boat passengers (U.S. Army Corps of Engineers 1980). Future well sites may also be nearer to shore and additional sites would eventually have a somewhat cumulative effect, despite the fact that noise of multiple sources is not directly additive. In addition, drill rigs would operate 24 hours a day, so that noise would be produced continuously, including during the night when sound propagation is often enhanced and sleep interference may be a concern.

5.102 Other drilling rig-related noise sources, such as foghorns, would also contribute to noise levels on shore. Class C foghorns, for example, have a specified minimum audible range of 0.5 miles (U.S. Army Corps of Engineers, Mobile, 1980). The closest specified well sites in Block 94 and 95 are within a 0.5-mile range, so that foghorn noise at these sites would affect the shore inhabitants. At Fort Morgan, which is the closest shore to the site in Block 94, Class C foghorn noise would result in approximately 60 dB outdoors, and 50 dB indoors. These levels are comparable to ambient levels, but they are above calm ambient levels. Foghorns would also be intermittent and therefore more noticeable.

5.103 Support vessels and aircraft would also contribute noise to the well site area. Noise data for bare engine noise of various Caterpillar Tractor engines are reviewed in Chapter 4. Expected vessel requirements for three offshore rigs, for example, are: three tugs, two supply boats, four crewboats and 14 barges (there are usually seven in the field at a time). Supply and crewboats would make daily trips to the rigs and tugs would make three trips per week. Helicopters would also intermittently produce noise. Heavy transport helicopters produce 70 to 90 dB at 1,000 feet (New England River Basin Commission, 1976).

5.104 In the final environmental impact statement concerned with exploratory/appraisal hydrocarbon wells in Mobile Bay, the U.S. Army Corps of Engineers (1980) cited drilling rig engines "likely to be operated during the project" were four 1,100-horsepower diesel engines, i.e., a total continuous horsepower of 4,400. Under average conditions, rig engines would operate at approximately 2,500 horsepower.

5.105 Solid and Hazardous Wastes. Routine drilling operations will not vary significantly from those in the Delta or in shallow water locations in the volumes or types of solid waste produced. All of the drilling alternatives require the use of drilling muds and cements and would produce waste streams of drill cuttings, cement, produced water, sanitary wastes, and incidental trash. Under the zero discharge regulations mandated by both Alabama and Mississippi regulation, all wastes are collected in barges for disposal onshore. The only potential differences in waste volume and characteristics from those described are the drilling depths (which may result in greater waste volumes) and the higher probability of using saltwater-based mud systems. Where rigs are located in offshore open waters, solid waste will primarily consist of drill muds with the addition of construction trash, garbage, and sanitary waste. All debris will be barged to shore for disposal at approved sites.

5.106 Socioeconomic Characteristics. Routine operations would generate a few short term effects. Traffic increases would be expected around a staging area as crews change and materials are delivered. Crews live on board during their tour. They do not participate significantly in a local economy unless they already reside in the area. Some local employment could be stimulated because certain support companies hire locals when possible. Local diving services or marine transportation might be needed, and minor equipment repairs could be performed. Details are provided in Chapter 4.

5.107 Navigation. Waterway traffic for a jackup or submersible rig would be the same as that for an inland drilling barge in these waters: an estimated maximum 1 waste barge trip every other day and 3 trips per day by crew boats for crew changes or delivery of supplies. The area occupied by the drilling rig would close an area 200 feet on a side to waterway traffic.

Fixed Platform

5.108 At locations where only several wells are to be drilled, it is likely that a mobile rig would be used for all wells and a platform erected only for the production phase. However, a fixed platform could be erected and used at any time.

5.109 In general, the environmental effects associated with construction and use of a fixed drilling platform would be very similar to those associated with a jackup or submersible drilling rig. Socioeconomic effects would differ somewhat because of the construction activity required.

Construction

5.110 Construction of a fixed platform is carried out in an on-land fabrication yard. A typical offshore fixed platform in the deeper waters of the region is a fixed-pile structure with a steel frame (Clark et al., 1978). It is about 150 feet by 90 feet, and the deck assembly is generally constructed in modules (U.S. Army Corps of Engineers, 1982a). Platforms are frequently customized according to specific needs of the operator. Some structures are designed only for development of the field, others may also handle production operations (New England River Basin Commission, 1976). The platform is brought to the site by boat. The substructure is secured to the bottom with piles. The decks are placed and secured to the substructure in the field. Drilling and support facilities, usually in modular form, are then placed on the platform. Pile clusters may also be constructed for support vessel mooring.

5.111 Water Quality. A fixed platform is constructed on shore in modules and brought to the site by boat where it is secured to piles. Impacts to surface water are due to the driving of piles as discussed for a drilling barge.

5.112 Hydrology. Impacts would be of the same types as described for the jack-up rig. Eddies may be somewhat more evident around a fixed platform than around a jack-up rig if more Bay or Sound surface area is displaced by a fixed platform. However, the extent of current eddies described for site preparation of an inland drilling barge would apply for a fixed platform as well.

5.113 Estuarine Ecosystems. Very little benthic area would be affected by platform erection at the well site. Turbidity effects, if any, would be confined to the immediate area and would last for a very short period.

5.114 Wastewater Disposal. Management of sanitary wastewaters and other liquid wastes is discussed under routine operations for an inland drilling barge.

5.115 Groundwater. Site preparation activities for drilling locations in the Bay or Sound would include no element that could produce impacts on groundwater resources.

5.116 Air Emissions. Air emissions associated with drilling are shown in Table 5-3.

5.117 Noise. Site preparation for fixed platform drilling rigs in Mobile Bay and Mississippi Sound is comparable to jack-up, submersible rigs, and offshore drilling barges. All require towing to the site, attendant vessels, and construction on location in preparation for drilling. Noise emission would be about the same level for each of the drilling operations.

5.118 Solid and Hazardous Waste. Solid waste from platform installation would be limited to construction debris and sanitary waste. Onshore disposal of waste materials would occur at approved sites.

5.119 Solid and Hazardous Wastes. Construction of a fixed platform would produce only small amounts of construction wastes. These would be barged to shore for disposal at an approved site.

5.120 Socioeconomic Characteristics. Platform development involves fabricating the structure, moving it to the site and installation (Wales et al., 1976). A number of platform fabrication yards are located in the Gulf coast states. It is likely that these existing facilities would be used to construct a platform for the Bay or Sound. New facilities could possibly develop in anticipation of local discoveries and production (Ernest, 1983. Personal communication). However, since transportation costs are a small percentage of the total investment, and not a significant factor in bids for local area jobs (Wales et al., 1976), existing fabrication yards along the Gulf Coast would receive the contracts. Size and complexity of the job play a more important role in determining which firm receives the contract.

5.121 Skilled labor is required to build the platform and the equipment to go on it. Specific labor categories required include: welders, mechanics and pipefitters. Pipefitters, and welders alone comprise as much as forty percent of a fabricators workforce (Wales et al., 1976; Havran and Collins, 1980). The number of workers required to build a platform varies with the design; several hundred could be involved for one large steel structure (Havran and Collins, 1980).

5.122 The installation of a platform has been estimated to require between 50 and 80 workers (Wales et al., 1976; U.S. Army Corps of Engineers, 1982a). Five of the 80 workers could come from the local community.

5.123 Erecting a platform offshore would take about a month. Initially, the main structural framework, the jacket, is placed. Modules are then towed to the site. If a local tug were used, employment for two to four more people could be generated. If an area firm were hired to construct and place the structure, several hundred individuals in the vicinity could be directly benefitted; otherwise, there would be only a minor contribution to the area's economy.

5.124 Navigation. Waterway traffic for fixed platform construction would include tugs with barges (for the platform subcomponents), a barge mounted crane and pile driver and crew boats for crew and supplies. The level of operations would be similar to that for a jackup or submersible, with no dredging or shell pad emplacement required. The construction operations (installation of platform and pilings) would last about one month during which the maneuvering of various vessels around the platform site would close an area 300 feet on a side to any waterway traffic. In terms of traffic volume, the greatest increase over existing conditions would be the crew boat movements, estimated at a maximum of 2 trips a day.

Routine Operations

5.125 Routine operations would be those activities required to drill the well. Drilling activities from a fixed platform would be identical to those for a mobile rig. All liquid and solid wastes would be collected in waste barges moored adjacent to the drilling platform and taken to an on-land disposal site approved for such wastes. The activity would be self-contained with personnel living on the rig. Personnel and materials would be brought to the location by boat, barge and, occasionally, helicopter.

5.126 The effects of routine operation of a fixed drilling platform would be virtually the same as those associated with the use of a jackup or submersible rig.

Inland Drilling Barge in a Salt Marsh

5.127 Salt marshes occur throughout the Mississippi Sound-Mobile Bay area (Chapter 3). Almost all areas under salt marshes could be reached by directional drilling from an upland or aquatic location. Exceptions are parts of the marshes in Mississippi Sound near the Grande Batture Islands between Bayou Casotte, Mississippi and the Mississippi-Alabama boundary, marshes on the southern end of Mon Louis Island just west of Cedar Point, and marshes between Waveland and the mouth of the Pearl River. It is possible that an inland barge drilling rig could be used to drill in those areas.

Site Preparation

5.128 Use of an inland barge drilling rig in salt marshes would require the dredging of a canal and slip for barge access. Site layout would be identical to that used in the Mobile Delta (see Chapter 4, Figure 4-1). Dredging of an approach channel would also be required to reach the salt marsh. Servicing of the drilling site would be by boat, barge and, occasionally, helicopter.

5.129 Water Quality. Site preparation activities and impacts are the same as for a canal and slip for an inland drilling barge in the Mobile River Delta. Even though oil and gas operations within marsh areas may include some site restoration activities, long-term impacts to water quality would occur due to the loss of benefits the marsh areas provide to water quality. The loss of marsh area extends from initial canal construction to the time when natural restoration of a filled-in, abandoned canal is completed.

5.130 Hydrology. Water velocities and water levels could increase substantially as a result of a canal and slip connected directly to the Bay or Sound. Tidal forces would push waters back and forth through the canal to the drilling barge more quickly than if the canal did not exist. Spills at the drilling barge could reach the Bay or Sound much more easily if an inter-connecting canal is present.

5.131 The mouth of the canal at the Bay or Sound would create current eddies within a few hundred feet of the canal in the Bay or Sound.

5.132 Wetland Ecosystem. As an upper limit, the area of salt marsh disturbed could be essentially the same as the area disturbed for a canal and slip in the Delta. In the Delta the access canal and stockpiled dredged material would disturb approximately 5 acres. In a salt marsh the size and depth of the canal and slip would be the same as in the Delta. However, the volume of dredged material placed adjacent to the canal would likely be less than in the Delta because of the small amount of land above the mean tide level. Therefore, the total area affected could be less than 5 acres per 1000 feet and 5 acres for a slip. The amount of disturbed area in open water could increase considerably by bank erosion from boat wakes, although this may depend on the amount of boat traffic, the types of wetland soils exposed to waves and the erosion protection measures used.

5.133 The direct loss of marsh area would eliminate the area as nursery and feeding areas for the life of the project. Because of the loss of marsh vegetation, export of organic detritus to the adjacent aquatic ecosystem would be eliminated. The presence of the canal could change the hydrology of the immediate area, possibly affecting the productivity of adjacent marsh areas.

5.134 Aquatic Ecosystem. Benthic area directly affected by dredging of an access channel to a salt marsh for an inland barge rig would be about 3 acres per 1000 feet of channel length. This assumes a 70-foot wide channel and a 70-foot wide material disposal area adjacent to channel, although the disposal area required could vary in area depending on the volume of material.

5.135 Up to 3 miles of a channel 8 feet deep could be required for access to Mon Louis Island. Access channels to wetlands near the Grande Batture Islands could be shorter, probably less than 1 or 2 miles. The benthic community within the channel and storage areas would be completely destroyed. Most of the area affected would consist of the coastal margin or open sound benthic infaunal assemblages (Shaw et al., 1982). No seagrass beds occur in these areas, but oyster reefs and oyster bottoms occur (May, 1971; Mississippi Department of Wildlife Conservation, 1982).

5.136 Turbidity resulting from the dredging of access channels could have a variety of effects on aquatic organisms in the vicinity of construction activities. These effects have been described in several environmental impact statements and assessments for activities in Mobile Bay and Mississippi Sound (U.S. Army Corps of Engineers, 1973, 1975b, 1977, 1979a). The effects of suspended solids include the physical burial of organisms, the clogging of gills and feeding apparatus, reduced light penetration limiting primary production, reduced dissolved oxygen concentrations from increased biochemical oxygen demand of suspended solids, and the release of nutrients increasing primary production (Stern and Stickle, 1979). Mobile organisms, such as fish, would be able to avoid turbidity plumes. However, planktonic organisms may be adversely affected because they could not move away. In addition, benthic macroinvertebrates residing near the channel may be affected by dredged material as it settles out of the water column. Some species of benthic organisms move freely through the sediment and can extricate themselves after burial under several inches of sediment or more. Other benthic species reside in permanent or semipermanent burrows or tubes and would be less likely to survive burial. Physically disrupted benthic communities tend to recover quickly (within several months) unless recovery is prevented by repeated disruption (Anderlini et al., 1975; Conner, 1977).

5.137 Of particular concern is the effect that the turbidity plume resulting from dredging operations could have on local oyster populations. Resuspended sediments could affect oyster reefs in the bay by physically burying them or by affecting physiological processes (Loosanoff and Tomers, 1948; Korringa, 1972). An additional concern would be potential effects on juvenile oysters (spat) as a result of dredging activities. Survival of oyster eggs, larvae and juveniles are reduced by increases in turbidity (Loosanoff, 1965; Davis and Hidu, 1969; Simon and Dyer, 1972). Only 73 percent of eggs survived when exposed to a suspended sediment concentration of 250 mg/l and only 30 percent when exposed to 500 mg/l. The growth of larvae was affected at suspended sediment concentrations of 705 mg/l, and no growth occurred above a concentration of 1,500 mg/l.

5.138 The productive Cedar Point oyster reefs are just to the southeast of the Mon Louis Island wetlands and the area to the south and west contain scattered reefs and oyster bottoms (May, 1971). Several small reefs are found near the months of tidal creeks in the marshes near the Grande Batture Island (Mississippi Department of Wildlife Conservation, 1981b). Depending on the route chosen, a channel to Mon Louis Island from the south would be within 1 mile or less of the Cedar Island reefs. Reefs near the Grande Batture Islands would be within 1/2 mile or less. The turbid bottom flow from hydraulic dredging disposal could reach these reefs. If deposition of sediment is thick enough on the reefs, those reef areas would probably be killed. Settlement of spat would not occur if suitable shell material were buried under sediments. The suspended sediment concentration in the water column could reduce oyster growth during the period the reef is covered by the turbid plume. Sedimentation could kill existing spat and reduce the suitability of the reefs to settlement of larvae.

5.139 Wastewater Disposal. Management of sanitary wastewaters and other liquid wastes is discussed under routine operations.

5.140 Air Emissions. Air emissions associated with drilling are shown in Table 5-3.

5.141 Noise. Preparations would be similar to those described for the Mobile River Delta unit action. Noise would result from clearing, dredging, towing, and barge mooring. The potential levels emitted are the same as those described for the Delta.

5.142 Solid and Hazardous Waste. Site preparation and development activities for shallow water drilling operations usually involve a combination of offshore and wetland area techniques. In the case of an inland drilling barge, installation and accompanying

solid wastes would be essentially the same type and lesser quantity as that described for the Delta.

5.143 Socioeconomic Characteristics. Site preparation procedures, local involvement and effects from preparing a site for an inland barge in a salt marsh would be the same as those described for the Mobile Delta (Chapter 4), except that no clearing operation would be required. Dredging, foundation preparation, and constructing the keyway could involve up to 20 workers; 9 or 10 to dredge an area and prepare the foundation and 4 to 10 to drive piles for the keyway. Local firms would have an opportunity to bid on these contracts. If successful, local businesses would benefit slightly for a short time.

5.144 Navigation. Waterway traffic to and from a salt marsh drilling site would be of similar volume to the traffic for an inland barge rig in the Delta. This traffic would include a barge mounted dredge, a barge-mounted pile driver (for installing the keyway after dredging is completed) and crew boat traffic. Such traffic levels would be relatively low and not expected to effect area navigation.

5.145 The greatest potential for navigation-related impacts would be connected with any dredged channel in the shallows leading to an access canal and slip in the marsh, particularly in the shallows near Mon Louis Island. Oyster boats cross this area frequently and spoil deposited adjacent to the dredged channel could produce areas too shallow to navigate safely unless channels in the spoil bank were provided and these channels indicated by navigation markers. (This would be similar to the channels crossing the spoil piles adjacent to the main Mobile Bay navigation channel).

Routine Operation

5.146 Routine operations are those activities necessary to drill a well. All liquid and solid wastes would be collected in waste barges moored adjacent to the drilling barge and taken to an on-land disposal site approved for such wastes. The activity would be a self-contained operation with personnel living on the rig. Personnel would be brought to the location by boat, barge, and helicopter.

5.147 Water Quality. Impacts to surface water during routine operation would be similar to those for a canal and slip for an inland drilling barge. There will be a greater exchange between canal waters and Mobile Bay or Mississippi Sound waters due to greater tidal influences and the effects will be greater due to the

higher salinity water in Mobile Bay or Mississippi Sound. The impacts due to the presence of canals in salt marshes are summarized by Longley, et al., (1981):

> Water flow in the canal may change depending upon canal location and area within the canal system. In the straight sections of the canal, within the realm of tidal influence, there is an increase in the volume of water exchange. There may be an acceleration of freshwater runoff from the marsh which can result in a lowering of the water table and a drying of higher marsh areas. On the other hand, the spoil placement may so block the natural marsh drainage that the marsh area is effectively impounded. In some instances the plants may be exposed to increased salinities and acid conditions. In other instances the impounded marsh area may have a lowered salinity regime and contain plant charactersitics of brackish and fresh marshes.
>
> Further away from tidal influence, conditions in the canal may be quite variable, and at time anoxic. There may be a buildup of organic matter because of the high proportion of organic sediment, limited aeration of the water column, and poor flushing similar to residential dead end canal problems. Possible buildups of sulfates in these canals have been noted, but other efforts have shown no systematic increase in canal sulfates compared to control areas. The canals, however, may have more variable conditions than do control areas.

Even though oil and gas operations within marsh areas may conclude with some site restoration activities, long-term impacts to water quality would occur due to the loss of benefits the marsh areas provide to water quality.

5.148 Hydrology. Impacts on hydrology are discussed for the inland drilling barge in a salt marsh under site preparation. As long as any canal is in place that connects the salt marsh to the Bay or Sound, the impacts discussed under site preparation and those summarized above under water quality would be evident.

5.149 Wetland Ecosystems. The salt marsh area within the canal and slip and under the material deposition pile would be lost as wetland area for the period that the canal remains in use. This could vary from only several weeks if a shallow well is drilled to several years if several deep wells are drilled from the same location. Bank erosion could continue depending on soil conditions, boat traffic and wave exposure. The area would be unavailable for

detritus production for export to the estuarine food chain or as nursery and feeding area for aquatic organisms during high tides. The area would also be lost as habitat for birds and mammals that utilize wetland areas. Revegetation of dredged material storage piles would occur slowly, creating upland-like habitat. Colonial nesting birds could be disturbed if adjacent to the drilling operation.

5.150 Aquatic Ecosystems. Recolonization of the area of a dredged channel, material storage area and area affected during dredging would begin as soon as disturbance ceased. Recovery would be rapid, probably requiring 6 to 18 months (Pfitzenmeyer, 1970; Taylor, 1972; May 1973b; Conner, 1977). If the sediment composition of the disturbed areas is different from adjacent areas, the benthic community that recolonizes could be somewhat different. The rate of dewatering of hydraulically dredged material could also delay recolonization until compaction is well along.

5.151 Oyster reefs buried by a thick sediment layer would not be reestablished unless new shell material suitable for larval attachment were placed there. Less thick sedimentation could also reduce the productivity of an affected reefs.

5.152 Wastewater Disposal. Management of sanitary wastewaters and other liquid waste would be the same as for the inland drilling barge and all other drilling alternatives for the Bay and Sound. Wastewaters, runoff, bilge waters and ballast waters would be stored in barges and periodically hauled to a sewer line or directly to a wastewater treatment plant for treatment and disposal. Impacts of accidential spills are discussed elsewhere.

5.153 Groundwater. During oil and gas production activities, precautionary measures will prevent a direct interface with fresh water-bearing aquifers. These measures include proper well casing and cementing, proper use of drilling muds, spill prevention, and proper installation and operation of injection wells. These topics are applicable to all areas of coastal Alabama and Mississippi and have been discussed at greater length in the previous section. The potential impacts for such aspects as well completion, gathering system construction, normal operations, and workover are the same as those described for these activities in the Delta.

5.154 Air Emissions. Air emissions associated with these activities are shown in Table 5-3.

5.155 Noise. Drilling noise produced by an inland drilling barge in a salt marsh would be similar to earlier drilling barge accounts. Noise levels from drilling and attendant vessels would not be attenuated by vegetation since marsh vegetation is short and patchy.

5.156 Solid and Hazardous Wastes. Routine drilling operations will require the use of drilling muds and cements which produce waste streams of drill cuttings, cement and produced water. Sanitary wastes, and incidental trash would also be generated by crew members living on board. Under the zero discharge regulations mandated by both Alabama and Mississippi regulations, all wastes are collected in barges for disposal onshore. Waste volumes and characteristics would differ from location to location and with varying drilling depths.

5.157 Socioeconomic Characteristics. The effects from routine operations on an inland drilling barge in the salt marsh are the same as those described for the operation with a canal and slip in the Delta (Chapter 4). The local labor pool could benefit slightly from two practices: policies of hiring local residents adopted by some service companies and contracting with local businesses for activities such as diving, marine transport, and minor equipment repairs. Auto traffic increases could also be expected near the staging area.

5.158 Navigation. Waterway traffic for drilling operations would be the same as that described for an inland drilling barge in the Bay or Sound: an estimated maximum of 1 waste barge trip every other day and 2 or 3 trips per day by crew boats. The potential impacts described under site preparation would continue for the life of the project.

Directional Drilling From Upland Location

5.159 Some parts of Mobile Bay and Mississippi Sound could be reached by directional drilling from an upland site, which would eliminate drilling from a water-based site. A lateral well deviation of about only one mile is possible with current technology at the 20,000-foot depths of primary interest in Mobile Bay and Mississippi Sound. Probably only a few percent of the Bay-Sound area would be accessible by this drilling method.

5.160 A shoreline location for a drilling rig would be possible along much of the western shore of Mobile Bay. A rig location would have to be further inland along most of the rest of the mainland area because of shoreline development. Location of

drilling rigs in developed areas would be possible if leases could be obtained from landowners. However, the likelihood of encountering gas containing hydrogen sulfide would greatly increase the danger to the public of such a drilling arrangement if loss of well control occurred.

5.161 Drilling could also take place in Mississippi Sound from the Barrier Islands and from Round and Deer Islands. Problems of site access and flooding during storms would make drilling at such a location more difficult than at mainland sites. A permit t drill on the islands within the Gulf Islands National Seashore would not be issued under current National Park Service regulations (Thackery, 1983, personal communication).

5.162 The effects of site preparation and operation of upland sites around Mobile Bay and Mississippi Sound are described in Chapter 7.

Cultural Resources

5.163 As a result of comments of the Alabama State Historic Preservation Officer on previous permit applications for oil and gas exploration in Mobile Bay, the District has required that a cultural resources survey be performed to identify potential resources prior to any project activities (U.S. Army Corps of Engineers, 1982a, 1982b). This survey involves a review of available literature on the area and a search of records for previously surveyed and recorded sites. Following the literature and records search a multi-sensor survey (including marine magnetometer and shallow seismic profiler or bottom coring device) of a proposed well location is run to identify any indications of cultural remains. Such surveys are expected to remain standard practice in the environmental review of any project. Should the multi-sensor survey identify a potential location of cultural remains, then either additional survey work is required to determine the nature of the potential site or the proposed project activities must be moved to avoid the location.

Commercial Fisheries

5.164 As detailed in Chapter 3, commercial fishing is a major industry for Alabama and Mississippi, amounting to nearly $75,000,000 in 1981. Three general categories of potential impacts could result from site preparation and drilling activities: direct loss of fishing area, interference with fishing operations, and space competition between fishing fleet traffic and oil rig traffic.

Loss of Fishing Area

5.165 For the various rig types that would be used in the Bay or Sound (drill barge, jackup, submersible), approximately 3/4 acre to 1 1/4 acres would be encompassed by the rig and its adjacent support vessel mooring. Such areas would be directly removed as fishing locations for the life of the well.

5.166 Although not covered by a rig or any other structure, a much larger area of fishing grounds would be affected by any channel dredged through shallows to reach a salt marsh drilling location. As previously described, such a channel and its adjacent spoil area would cover about 3 acres per 1000 feet of channel or approximately 40 acres for 2 1/2 miles of channel crossing the shallows. Half of this area would be deepened from its average 3 to 5 foot depth to a new depth of 7 to 8 feet. The other half would be shallower with possibly only a foot or less of water above the adjacent spoil pile. Since the shallows south of Mon Louis Island are a primary area where such channels could be dredged and since these same shallows are an important part of the area's oystering activities, such dredged channels and the adjacent spoil piles could significantly affect a large portion of the area supporting the local oyster industry.

Fishing Vessel Maneuvering

5.167 A second area of potential fisheries impact is the possible conflict between the location of a drilling rig or platform and the maneuvering of a fishing vessel while actively fishing. A fishing vessel towing a net needs a larger maneuvering area than a fishing vessel not towing a net. This is particularly the case when turning. In order to avoid any drilling rig and to give an extra margin of safety, a drilling rig could generally be fished no closer than 150 to 200 feet (Centaur Associates, Inc., 1981). This would effectively close 4 to 7 acres around a rig to any commercial fishing using towed nets.

Space Competition Between Fishing Vessels and Oil Rig Vessels

5.168 Although the various oil rig vessels would add to the volume of waterway traffic, it is not expected that the rig-related vessel traffic would be of such a level as to interfere with fishing boats going to and from their home ports. Many of the fishing boats leave port in the very early hours before the rig traffic would start and, depending on type of fishing, fishing success and weather conditions, would return at various times throughout the day and night.

5.169 An area of potential conflict could be the competition for dock space between fishing vessels and oil rig vessels. Some concentration of oil rigs could produce sufficient requirements for dockage that the oil rig vessels would be in competition for the same dock space as fishing vessels and if the oil rigs outbid the fishing vessels, commercial fisheries could be affected.

Transport and Fate of Spilled Oil

5.170 A large uncontrolled spill would be transported by tidal currents and wind. The lighter weight soluble aromatic fractions, which are quite toxic, would dissolve in the water and be mixed into the water column by turbulence.

5.170a Probabilities of accidents occurring can vary depending upon engineering, installation and operation-maintenance procedures. Based on current technology, the probability of a well blowout is estimated to be one for 250 wells, and the probability of a pipeline rupture is estimated to be 0.00138 incidents per year per mile of pipeline. Both well blowouts and pipeline ruptures could spill a wide range of hydrocarbon quantities depending upon the reason for the accident and the quickness with which the spill is controlled.

5.171 Some characteristics of Louisiana (light) crude oil are particularly worth noting regarding spills in the Bay or Sound:

- Most toxic fractions (low molecular weight compounds) evaporate and dissolve within three days following a spill.

- Spilled oil is not trackable after approximately 30 days.

- Crude oils are generally more viscous and longer lasting but less toxic than refined oils.

- "Slick" enlargement is completed in approximately four days.

The significance of various oil conversion processes for Louisiana crude oil is as follows (U.S. Department of the Interior, 1985g):

Process	Time Scale (Days)	Approximate Percentage of South Louisiana Crude Oil Slick Volume Converted
Evaporation	1 to 10	45
Dispersion	1 to 30	10
Dissolution	1 to 10	1
Oxidation	3 to 365	5
Settling and biodegradation	10 to 365	25
Tar residue	10 to 365	1
Other or unaccountable	--	10 to 15

5.172 Water speeds and directions are affected by such a myriad of forces that prediction of water movement in the time frame of a few hours or even a few days is not possible. Distances which a spill of Louisiana crude oil could travel at or near the water surface can be estimated, however, water velocity data available to do these estimates was limited, particularly for Mobile Bay away from the passes. As shown in Table 4-10, travel distances can be predicted based on current and wind velocities for average and worst-case conditions. For Mobile Bay and Mississippi Sound, water velocities and wind speeds near locations of sensitive habitats have been evaluated as much as available data would allow; predominant directions of water movement near sensitive habitats have also been evaluated.

5.173 Tables 5-4 and 5-5 present estimated straight-line distances spilled Louisiana crude oil could travel during one-half of a tidal period (13 hours) under average and worst case conditions respectively. Figures 5-6 (end of chapter) and 5-7 (end of chapter) show spill velocity vectors for the average-case and worst-case conditions. Information shown in Tables 5-4 and 5-5 and in Figures 5-6 and 5-7 are based on water velocities that have been observed near various ecologically sensitive habitats or other important locations. Movement of spills within Mobile Bay are based on water velocities measured at only two buoys within the main channel, because no other reported data were available. For Mississippi Sound, average water velocities near the water surface at various locations have been reported (U.S. Army Corps of Engineers, 1983c and 1983d).

TABLE 5-4

MOST LIKELY SPILL MOVEMENT CHARACTERISTICS
IN MOBILE BAY AND MISSISSIPPI SOUND
FOR THE AVERAGE CASE

Sensitive Location	Predominant or Average Direction of Water Movement within Bay[1] or Sound[2] (same for the average and worst cases)	Average Surface Current Speed[2,3] Feet Per Second	Wind Speed[4] Miles Per Hour	Linear Spill Travel Distance in 13 Hours,[5] Miles
Mobile Bay				
Seagrass beds in northernmost portion of Bay	From north	See Table 4-16b	0	Not applicable (see Table 4-16b)
Salt marsh adjacent to Dog River north of Theodore Industrial Park	From north (ebb tide) and clockwise (flood tide)	0.5	0	4.9
Oyster reef(s) southeast of Point Clear	From north (ebb tide) and counterclockwise (flood tide)	0.5	0	4.9
Fowl River salt marsh	From north adjacent to shoreline (ebb tide) and southeast to northwest (flood tide)	0.5	0	4.9
Cedar Point	From northeast (ebb tide) and from southeast (flood tide).[1] Average current is from the southeast of Dauphin Island Bridge.[2]	1.3[1]	0	12.0

TABLE 5-4
(Continued)

Sensitive Location	Predominant or Average Direction of Water Movement within Bay[1] or Sound[2] (same for the average and worst cases)	Average Surface Current Speed[2,3] Feet Per Second	Wind Speed[4] Miles Per Hour	Linear Spill Travel Distance in 13 Hours,[5] Miles
Mobile Bay				
Weeks Bay	From northeast (ebb tide) and from south (flood tide)	0.5	0	4.9
Southeastern Bon Secour Bay	From east (ebb tide) and circular (flood tide)	0.5	0	4.9
North shore of Ft. Morgan Peninsula	From east along shoreline (ebb tide) and from eastern half of Main Pass (flood tide)	0.5	0	4.9
Mississippi Sound				
Salt marsh from West Fowl River westward to Point Aux Chenes	From northwest to southeast off Bayou Le Batre and from southwest to northeast off Point Aux Chenes	0.1	0	1.4
Shrimp nursery area northwest of Cedar Point	From northwest to southeast off Bayou Le Batre	0.1	0	1.4
Western half of north shore of Dauphin Island	From northwest (ebb tide) and from east (flood tide)	0.1	0	1.4

TABLE 5-4

(Continued)

Sensitive Location	Predominant or Average Direction of Water Movement within Bay[1] or Sound[2] (same for the average and worst cases)	Average Surface Current Speed[2,3] Feet Per Second	Wind Speed[4] Miles Per Hour	Linear Spill Travel Distance in 13 Hours,[5] Miles
Mississippi Sound (cont'd.)				
North shore of Petit Bois Island	From northwest to south-east in mid-Mississippi Sound	0.2	0	2.3
North shore of Horn Island	From west to east in mid-Mississippi Sound	0.1	0	1.4
Pascagoula River-Delta	No data, predominant current is presumably from north to south due to freshwater inflow	---	0	---
Biloxi area	From southwest to north-east off mouth of Biloxi Bay	0.05	0	0.9
Cat Island	From west to east in mid-Mississippi Sound and from south to north on either side of the island	0.1	0	1.4
Bay St. Louis area	Data from measurements southwest and [illegible] of Bay [illegible]	0.1	0	1.4

TABLE 5-4

(Continued)

1 Reference: Chermock, 1974.

2 Reference: USACoE, 1983c for mean current from April-October 1980 approximately 1.5 meters below the water surface near the sensitive locations listed in the column on the far left.

3 Regrettably, very few current data have been reported for locations within Mobile Bay (not including the passes). 0.5 feet per second is the average current measured during two 24-hour periods during May 1972 and June 1973 (Jarrell, 1981).

4 Based on Table 3-7 in this Draft EIS.

5 Based on a spill travelling in a straight line for 13 hours at the average surface current speed. Effects of inertia and density, viscosity and surface tension differences between oil and water are included.

6 Reference: Ling, 1981.

TABLE 5-5

MOST LIKELY SPILL MOVEMENT CHARACTERISTICS
IN MOBILE BAY AND MISSISSIPPI SOUND
FOR THE WORST CASE

Sensitive Location	Predominant or Average Direction of Water Movement within Bay[1] or Sound[2] (same for the average and worst cases)	Average Surface Current Speed[2,3] Feet Per Second	Wind Speed Miles Per Hour	Linear Spill Travel Distance in 13 Hours,[4] Miles
Mobile Bay				
Seagrass beds in northernmost portion of Bay	From north	See Table 4-16b	40	Not applicable (see Table 4-16b)
Salt marsh adjacent to Dog River north of Theodore Industrial Park	From north (ebb tide) and clockwise (flood tide)	2.2	40	38.
Oyster reef(s) southeast of Point Clear	From north (ebb tide) and counterclockwise (flood tide)	2.2	40	38.
Fowl River salt marsh	From north adjacent to shoreline (ebb tide) and southeast to northwest (flood tide)	2.2	40	38.
Cedar Point	From northeast (ebb tide) and from southeast (flood tide). Average current east of Dauphin Island Bridge is from the south.[2]	3.8[5]	40	52.

TABLE 5-5
(Continued)

Sensitive Location	Predominant or Average Direction of Water Movement within Bay[1] or Sound[2] (same for the average and worst cases)	Average Surface Current Speed[2,3] Feet Per Second	Wind Speed Miles Per Hour	Linear Spill Travel Distance in 13 Hours,[4] Miles
Mobile Bay				
Weeks Bay	From northeast (ebb tide) and from south (flood tide)	2.2	40	38.
Southeastern Bon Secour Bay	From east (ebb tide) and circular (flood tide)	2.2	40	38.
North shore of Ft. Morgan Peninsula	From east along shoreline (ebb tide) and from eastern half of Main Pass (flood tide)	2.2	40	38.
Mississippi Sound				
Salt marsh from West Fowl River westward to Point Aux Chenes	From northwest to southeast off Bayou Le Batre and from southwest to northeast off Point Aux Chenes	1.3	40	30.
Shrimp nursery area northwest of Cedar Point	From northwest to southeast off Bayou Le Batre	1.3	40	30.
Western half of north shore of Dauphin Island	From northeast (ebb tide) and from east (flood tide)	1.3	40	30.

TABLE 5-5

(Continued)

Sensitive Location	Predominant or Average Direction of Water Movement within Bay[1] or Sound[2] (same for the average and worst cases)	Average Surface Current Speed[2,3] Feet Per Second	Wind Speed Miles Per Hour	Linear Spill Travel Distance in 13 Hours,[4] Miles
Mississippi Sound (cont'd.)				
North shore of Petit Bois Island	From northwest to southeast in mid-Mississippi Sound	1.4	40	31.
North shore of Horn Island	From west to east in mid-Mississippi Sound	1.4	40	30.
Pascagoula River-Delta	No data, predominant current is presumably from north to south due to freshwater inflow	---	40	19. w/out current
Biloxi area	From southwest to northeast off mouth of Biloxi Bay	1.0	40	28.
Cat Island	From west to east in mid-Mississippi Sound and from south to north on either side of the island	1.6	40	33.
Bay St. Louis area	Data from measurements southwest and east of Bay St. Louis show average currents are from the west and south	2.0	40	36.

TABLE 5-5

(Continued)

[1] Reference: Chermock, 1974.

[2] Reference: USACoE, 1983c for mean current from April-October 1980 approximately 1.5 meters below the water surface near the sensitive locations listed in the column on the far left.

[3] Regrettably, very few current data have been reported for locations within Mobile Bay (not including the passes). 2.2 feet per second is the highest current speed measured during two 24-hour periods during May 1972 and June 1973 (Jarrell, 1981).

[4] Based on a spill travelling in a straight line for 13 hours at a speed equal to the maximum surface current speed plus 3.5 percent of the maximum wind speed. Effects of inertia and density, viscosity and surface tension differences between the oil and water are included.

[5] Reference: Jarrell, 1981.

[6] Reference: Ling, 1981.

5.174 From Table 5-4, spills of crude oil in Mobile Bay could travel from 1 to 12 miles under average-case conditions at speeds of 0.10 to 1.4 feet per second. Based on predominant directions of water movement, spills would most likely affect sensitive habitats if the origin of the spill is in line with the directions of water movement shown in Figure 3-12. For 3 and 12-hour response times, distances a spill could traverse for the average-case conditions are as follows:

Spill Velocity, feet per second	Travel Distances, feet
0.10	1,100 after 3 hours 4,300 after 12 hours
1.4	15,000 after 3 hours 60,000 after 12 hours

Hydrocarbon spills from rigs or pipelines located near passes could travel particularly far. Spills within areas with low water speeds such as presumably Bon Secour Bay would linger in one portion of the Bay at higher hydrocarbon concentrations than in portions of the bay with higher water speeds. Spills in the delta could affect large portions of Mobile Bay because flows from upstream areas profoundly affect upper Mobile Bay water movements. In addition, waters can move in directions different from the predominant direction of water movement. Net cross-channel flows in Mobile Bay, for example, can occur in upper and lower Mobile Bay either from the east or west depending upon wind conditions (Raney and Youngblood, 1982). With a cross-channel velocity of 0.5 feet per second in one direction, a spill mid-way across the bay could reach the bay shoreline in approximately 16 hours.

5.175 Spills under average-case conditions in Mississippi Sound would not travel as far as in Mobile Bay based on available data and results shown in Table 5-4. Both freshwater flows from rivers and tidal effects are greater in Mobile Bay than in Mississippi Sound; effects of the Mississippi River in western Mississippi Sound do not seem to increase surface current speeds. Because tidal effects are not as great in Mississippi Sound, an uncontrolled spill could probably always travel further than the distances shown in Table 5-4. Figure 5-6 shows that surface currents originating from some current meter locations in Mississippi Sound show spill movement toward sensitive locations would occur.

5.176 For worst-case conditions, results shown in Table 5-5 and Figure 5-7 show that a spill could traverse Mobile Bay from any spill site, assuming the spill travels in a straight line under the extreme conditions. The likelihood that such extreme conditions would persist for more than a few hours is considered remote. However, within 4 hours, a spill could travel 8 miles at a speed of 3.0 feet per second. The spill speeds represented on Table 5-5 range from 2.1 to 5.9 feet per second. Effects of a 40-mph wind are estimated to be the same as effects of a 2.1 feet-per-second current at the water surface. Within Mississippi Sound, a spill could similarly traverse half of the Sound along the east-west axis. Clearly, marsh shorelines and other sensitive locations could be endangered within 13 hours of a spill.

5.177 As the result of an oil spill in 1979, seven kilometers southeast of the Galveston (Texas) entrance, impacts were noticed at beach areas as far as 470 kilometers from the spill even though only 2,100 of the 250,000 spilled barrels were observed to reach shore (American Petroleum Institute, 1981). Hence, large oil spills can travel distances much greater than the width of Mobile Bay or the length of either Mobile Bay or Mississippi Sound. Normally a slick has completed enlarging in approximately four days (U.S. Department of the Interior, 1983a).

5.178 The less soluble saturated fraction of the oil would be sorbed to particulate matter or dispersed as microdroplets (depending on wave conditions) and carried to the bottom sediments (Wade and Quinn, 1980; Olsen et al., 1982; Gearing and Gearing, 1982; Gearing et al., 1980; Elmgren and Frithsen, 1982). On the bottom, the oil would be mixed into the sediments by the bioturbation of the benthic organisms.

5.179 Once in the sediments, oil could remain for several months to many years. Residence time would probably be shortest in the higher energy areas such as inlets. Sediment oil persistance would likely be long (years) in most of Mobile Bay and Mississippi Sound (Mayo et al., 1974; Dow, 1975; Dow and Hurst, 1975; Conner, 1979).

5.180 In shallow areas, oil can be released from sediments to move along the bottom by currents. Spills near shore thus have more immediate and long-term adverse impacts than spills which have had opportunities to evaporate and dilute significantly. Less dense oils, such as refined oils, on the other hand, leave less residue which can reach sediments or shoreline, assuming the oil has had time to evaporate and dilute.

5.181 The time of year that a spill occurs is a second important consideration in assessing environmental impacts. Physical, chemical and biological processes are dynamic, so that characteristics in Mobile Bay and Mississippi Sound vary from month to month.

Effects of Spills and Loss of Well Control

5.182 If loss of well control occurs during drilling, natural gas and/or crude oil could be released to Mobile Bay or Mississippi Sound. In addition, substances are used on the drilling rig or support vessels that, if spilled, could have adverse effects on the aquatic environments. Potentially hazardous or toxic materials include the following:

- Crude oil
- Fuel, lubricants and hydraulic fluids
- Chemicals
- Drilling fluids
- Natural gas containing hydrogen sulfide

The environment effects of spills of natural gas, crude oil or other material have been discussed in several environmental impact statements and assessments for the Mobile Bay region (U.S. Army Corps of Engineers, 1975a, 1980, 1982a, 1982b).

Crude Oil

5.183 The discovery of crude oil in the formations underlying Mobile Bay and Mississippi Sound is considered unlikely (see Appendix B). However, if oil were discovered and a large uncontrolled spill occurred the environmental effects could be extensive.

5.184 The effects resulting from a crude oil spill would depend on a number of factors such as spill size, oil characteristics, quickness of containment response, effectiveness of cleanup, areas affected and time of year. The characteristics of the oil that might be discovered are not known but it is likely that it could be a light crude similar to South Louisiana crude (see Chapter 6) or that typical of the existing fields in northern Mobile County (see Chapter 4). This type of oil would have many characteristics similar to some fuel oils.

5.185 Effect on Benthic Organisms. Mortality of benthic organisms from acute toxic effects could be expected in areas most affected by the spill, especially in shallow areas (Dow and Hurst, 1975; Conner, 1979). Dilution and loss by evaporation of these fractions would reduce the concentration of toxic components at greater distances from the spill site.

5.186 The effect of residual oil in the sediments would depend on the concentration. Uptake of oil by benthic organisms is likely, but would vary with species (Elmgren and Frithsen, 1982; Farrington et al., 1982). In areas where concentrations are great enough, benthic community composition could be altered and the growth rate of organisms reduced (MacDonald and Thomas, 1982; Grassle et al., 1981; Oviatt et al., 1982; Elmgren and Frithsen, 1982). Effects on oysters are discussed in section on effects of spills and commercial fisheries.

5.187 Effects on Motile Fish and Shellfish. Because fish and shellfish are mobile, the effects of oil spills on them are more difficult to predict. Some direct mortality would occur during the early period of the spill. Longer term concerns include indirect effects such as reduced food sources, sublethal effects on growth and incidence of disease, and bioconcentration of hydrocarbons in tissues within the higher trophic levels of the food web (Eldgridge and Echeveria, 1977; Brown, 1980; Barnett and Toews, 1978; Statham et al., 1978).

5.188 Effects on Birds. High rates of mortality among pelagic birds, shorebirds and waterfowl populations can result from a large oil spill. Rank order of susceptibility is (1) grebes, pelicans, seaducks, cormorants and other diving birds; (2) geese, ducks, shorebirds; (3) gulls, terns, cranes, and herons (Conner and Alkon, 1978). The potential for damage to birds is partly dependent on season and the type of oil spilled. The overwintering period would be of particular concern because migratory waterfowl and other birds would be present in greatest numbers, particularly in the southern Mobile Delta and northern Mobile Bay.

5.189 Bird susceptibility to oil is influenced by toxicity and direct exposure to the oil; crude oil is less toxic than refined oil, and fresh oil causes more damage than weathered oil (Clapp et. al., 1982). The major effect would be during the early stages of a spill. Direct mortality may occur when feathers are oiled causing loss of natural insulation and floatation ability, which may result in shock, hypothermia and drowning. Human rescue and de-oiling missions have been carried out during oil spills, but have been largely unsuccessful in reducing overall population mortality.

5.190 Sublethal and indirect effects of oil on birds may also occur. Ingestion of oil can reduce reproduction. Fouling of eggs with oil from feet and breast feathers can cause high embryo mortality, morphological abnormalities, and reduce hatching rates (Spinks, 1982).

5.191 Effect on Marsh Communities. Oil reaching salt marshes could kill sediment organisms and vegetation if the plants are coated (Hellebust, 1975). Vegetation would be stressed if not killed (Smith et al., 1981). Surface oil may reduce plant productivity up to 88 percent and reduce the conversion rate to detritus up to 50 percent (Brown, 1980). Residual oil in salt marsh sediments could remain for years (Macko et al., 1981; Conner, 1979) and act as a source of continued contamination for nearby estuarine areas. A variety of sublethal effects could result from oil residual (Krebs and Burns, 1977).

5.192 Sensitivity of Shoreline Habitats. Habitats vary in sensitivity to the damaging effects of spilled oil. In general, high energy environments are least sensitive and lower energy environments are most sensitive (O'Neil et al., 1983; U.S. Department of the Interior, 1983h). These areas have been identified and mapped for Alabama (O'Neill et al., 1983) but not for Mississippi. Generalizations from the Alabama study can be made, however. In Mobile Bay and Mississippi Sound, the areas of least ecological sensitivity are the sandy beaches in the vicinity of the inlets. The high energy of waves, currents, tides and sediment movement in these areas would result in the removal or covering of spilled oil. Areas of intermediate ecological sensitivity would be sandy beaches within the estuarine system where sediments are relatively fine, and current and wave action is less than near the inlets or along the gulf beaches but greater than in the marsh areas. The fine sediments reduce the penetration rate of hydrocarbons. Shoreline and other habitats of high ecological sensitivity are marshes, seagrass beds, oyster reefs, tidal [illegible], and marine bird nesting areas.

Fuel Oil

5.193 Each drilling rig would require refueling with diesel fuel approximately every [illegible] weeks. A spill could occur during fuel transfer operations from the fuel tender to the drilling rig. Such spills are rare and usually minor in volume. As a precaution oil containment booms would be deployed during refueling.

5.194 A typical fuel storage capacity on a rig would be 75,000 to 100,000 gallons. If this entire volume or a large portion of this volume escaped the curbs and drains on the rig and was not contained by on-rig oil spill response equipment, a local fuel spill could disrupt the marine fish, planktonic, and benthic and terrestrial communities, and wetlands of a portion of Mobile Bay. The duration and extent of this event would depend upon time of year, hydrographic conditions and the proximity to any particularly critical area such as an oyster reef. A detailed discussion of the potential physical and biological fates and effects of spilled fuel oil is provided in the appraisal program environmental impact statement (U.S. Army Corps of Engineers, 1980).

5.195 Transport of fuel oil to and from the drilling location also increases the risk of a spill from a collision or other marine accident. A typical fuel transport barge that might be used contains 40,000 gallons. However, the shipment of hazardous materials in the channels in Mobile Bay and Mississippi Sound is routine. For example, at least 5 million barrels of refined petroleum products are shipped along the Intracoastal Waterway annually in Alabama and Mississippi waters (U.S. Army Engineer Institute for Water Resources, 1979).

Chemicals

5.196 A variety of chemicals and materials such as hydrochloric acid, drilling fluid additives, lubricants and rig paints would be on each rig during drilling operations. Solvents, additives, paints, and other chemicals can undergo chemical alteration as well as physical dilution once spilled. Many of these chemicals are able to vaporize to some extent. Tech Con, Inc. (1980) reported that 700 gallons of 12-normal hydrochloric acid spilled at Mobile well number 1-76 had no noticeable impact on pH of the water. Presumably, wind velocities of 15 to 20 knots which were evident following the spill helped to minimize adverse water quality impacts. Chemical spills have some localized adverse effects, although these materials generally would disperse quickly due to dilution and evaporation.

Drilling Fluids

5.197 Drilling operations involve the use of drilling fluids (muds), which are mixtures of clay, water and various chemical additives that lubricate the drill bit and the drill string (steel pipe which attaches the bit to the drilling rig) and remove cuttings from the drill hole. The used drilling fluids, along with other liquid waste such as stormwater and secondarily treated wastewater,

would be transported by barge to a disposal site on land. In an accidental spill from a waste transport barge, as much as 5,000 barrels of liquid wastes could be discharged into the estuarine waters.

5.198 If a barge lost its load of used drilling fluids, most of this material would sink rapidly to the bottom of the bay. The main effects of a spill of used drilling fluids would be an alteration of the texture and chemical composition of the affected bay bottom. These effects would be localized. Some supernatant that could contain toxic materials would be carried and dispersed by water currents at the site of the accident.

5.199 Accumulations of spilled drilling muds near the Texas coastline created barium concentrations near the spill site of approximately 1,000 milligrams per liter which well exceed normal background levels of 100 to 200 milligrams per liter. Spilled drilling fluids would settle in shallow estuarine waters and disperse depending upon water movements, salinity, temperature and drilling fluid characteristics at the time of the spill. Formation waters normally disperse more easily than drilling muds.

5.200 Unpermitted discharges during April 1982 of liquid wastes to Mobile Bay on both sides of Main Pass resulted in an anonymous complaint. Wastes may have been discharged intermittently from operations of 94-2 and 95-1 appraisal wells over a time span possibly as long as 15 months from the Spring of 1981 to June 1982. A monitoring program performed by a team of numerous consultants (Epsey Huston and Associates, 1982) was begun in late June 1982. Water-based and oil-based muds were utilized at these two wells.

5.201 Sediment-water column and benthos sampling efforts resulted in a nine volume report. Some of the conclusions are as follows (Epsey Huston and Associates, 1982):

- The impacts of present drilling operations, past operation and accidental discharges of drilling materials has not significantly altered the biota of surrounding Mobile Bay.

- Water column measurements also showed no significant environmental effects.

- Based on aluminum to barium and iron to barium ratios, patchy concentrations of oil-based drilling fluids were observed near the two wells where discharges occurred. No hydrocarbon concentrations indicating contamination were

monitored more than 200 yards from the drilling rigs. Slightly elevated aluminum to barium and iron to barium ratios were found at one station as far as 250 yards from well 94-2. Most of the oil has been found within 100 feet of the two wells. Benthic organisms were not found to be stressed near the two wells; no significant effects on biota, including oyster contamina- tion, were detected.

5.202 Water-based muds discharged to the water column separate into an upper plume containing five to ten percent of the material and a lower plume which descends to the bottom within a few tens of meters of the discharge. According to Epsey Huston and Associates (1982), Petrazzuolo has concluded in a report to the U.S. Environmental Protection Agency that the upper plume of a mud discharge would be dispersed by a factor of 10,000 within 100 yards of the discharge location. No mention is made of the effect of current speed or other factors on dilution. Parafin-based muds would disperse more slowly and less significantly due to being of a more cohesive nature than water-based muds.

5.203 Effects of a spill of used drilling fluids would be greatest if an accident occurred in the vicinity of sensitive and valuable natural resources such as those locations tabulated by O'Neil, et. al. (1983). For example, if drilling fluids were spilled from a barge in the vicinity of the Dauphin Island Causeway, the nearby Cedar Point Oyster Reef could be adversely affected.

5.204 In Alabama, a drilling mud program must be approved by the Alabama Department of Environmental Management in advance of drilling. A list of mud constituents are approved for use. If constituents not on this list were subsequently determined to be required, the new constituents must be submitted to the ADEM for review and approval for addition to the list.

Natural Gas Containing Hydrogen Sulfide

5.205 Loss of well control resulting in a flow of gas into the water column could occur. Natural aquatic organisms could be affected by the toxic effects of gas components that dissolve in the water and by physical destruction and burial that results from formation of a crater at the site of the accident.

5.206 Gas Dissolved in the Water. The effect of hydrogen sulfide that would dissolve in the water has been discussed in Chapter 4. In the aerobic estuarine waters, the major effects of biological concern would be a local reduction in oxygen concentration, which would be partially offset by entrainment of oxygen from the atmosphere in the turbulent action of the bubbling gas.

5.207 Physical Effects from Crater Formation. If the gas escapes through the casing below the sediment surface, a crater may form around the site where the gas enters the water column. The size of the crater formed can be large under catastrophic conditions. To give an extreme example, an accident in the Gulf of Mexico in 1976 resulted in a crater 430 feet deep and 1050 feet wide with collapse of the drilling platform. Several million tons of sediment were resuspended into the water and redeposited around the crater during the several weeks that the gas flowed in high volumes (Brooks, et al., 1978). Most material wasa redeposited within 1.5 miles of the center of the crater but some material was carried away in prevailing currents.

5.208 The above example represents an extreme worst case. More typical accidents would result in smaller craters or none at all and much more rapid control of the gas flow. Complete collapse of the platform is rare.

5.209 Benthic organisms would be lost in the crater and in the adjacent area of heavy deposition. Sediment could be carried considerable distances if tidal currents are strong. If the accident occurred near oyster reefs or seagrass beds, considerable damage could result from deposition of sediment.

5.210 Recovery rate of benthic organisms in altered areas outside the crater would probably be similar to that on areas affected by dredging and pipeline emplacement. Sediment composition could determine the type of community that developed. Within the crater, the benthic community that develops could be determined by whether low oxygen or anoxic conditions developed during part of the year. Oyster reefs would require the placement of new shell material if deposition of sediment was thick. Submerged aquatic vegetation may regrow, but recovery could require many years. The sediment composition could determine regrowth potential. Light penetration may be inadequate for regrowth of submerged aquatic vegetation to take place in the deeper parts of the crater.

Effects of Spills or Loss of Well Control on Commercial Fisheries

5.211 Commercial fishing could be severely affected by the loss of stock that could result from a spill and from the disruption of activities that would result from the presence of oil in the water and sediments. The greatest potential impact of a spill would be to the oyster reefs in the area, particularly the Square Handkerchief Reef complex in western Mississippi Sound and the Cedar Point Reefs near the Dauphin Island Bridge. These reef areas

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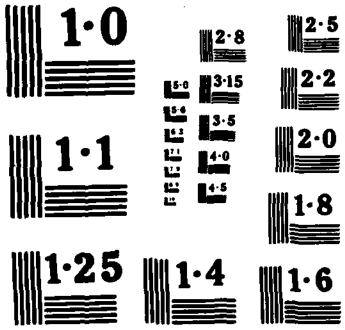

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MICROCOPY RESOLUTION TEST CHART

contain 80 to 90 percent of the commercially productive reefs in the area. A spill could directly kill the oysters while oil residues in sediments could cause a reduction in growth or impart a taste that would affect the market value of any catch, possibly for several years. A spill could also affect the production and development of oyster spat and reduce the bottom areas needed for growth. A massive spill that hit either of these reefs could cause the loss of millions of dollars to the oyster industry.

5.212 Tainting of commercial species of fish, crustaceans, clams, oysters and mussels by petroleum components has been widely reported (literature reviewed in Connell and Miller, 1981) and may be an important long-term effect on some commercial species. Tainting can occur from ingestion of petroleum in food and absorption from the water through the gills and integument. The acquisition of a tainted taste can be rapid, often occurring within hours from every low concentrations of petroleum in water.

5.213 Oysters have been tainted at low levels of dissolved hydrocarbons (0.01 to 0.001 ppm). Depuration after placing tainted oysters in clean water has been found to take several weeks (literature cited in Connell and Miller, 1981).

5.214 Shrimp and crabs have also become tainted after an oil spill, but the taint may have resulted from the dispersant used in the cleanup operation rather than the spilled oil. Results of experiments with the shrimp Crangon crangon indicated that external contamination or the presence of oil in the gut did not necessarily result in tainting of the flesh (literature cited in Connell and Miller, 1981).

5.215 Tainting of fish is difficult to predict since they could avoid contaminated areas. Results of laboratory experiments and analysis of fish collected from areas receiving oil-contaminated wastewater discharges have found objectionable odors or tastes in the fish (literaure reviewed in Connell and Miller, 1981).

Socioeconomic Effects of Spills or Loss of Well Control

5.216 The major recreational beaches and water related activities in coastal Alabama and Mississippi are potentially vulnerable to an oil spill or accidental release of gas from wells in the Sound or Bay. A material spill could be particularly detrimental to area beaches and recreational fishing, major sources of local and statewide income. Depending on wellhead proximity and the hazardous contents of natural gas, an accidental release could lead to an evacuation of vacationing populations. In either case,

revenues generated by the water-oriented tourist business would drop. The extent of economic damage would depend on the type of accident, the quantity of material, and the time and resources available to contain and clean up the pollutants.

5.217 Coastal Alabama accounts for about one quarter of the statewide tourist industry estimated to be worth about $2.5 billion in 1981 (Adams, 1981). The major tourist activity occurs on shores facing the Gulf. A spill in the Bay, however, could affect recreational fishing and boating activities in Bay waters.

5.218 Statistics on the Alabama recreational fishing and boating industry tend to address the economic importance of coastal Alabama as a whole, not differentiating among the Bay, Sound and Gulf waters. However, it is known that most marine shoreline fishing in Alabama occurs in Mobile county along the Bay, and that recreational fishing from private boats is concentrated along the inshore areas of Baldwin county. Also, pier fishermen rank second in the number of individuals participating in marine sport fishing, in total investment and in total catch (U.S. Army Corps of Engineers, 1979a).

5.219 Effects on Alabama Gulf beaches could also occur from an accident in the Bay if currents and wind directed the pollutants through the inlet between Dauphin Island and the Fort Morgan peninsula. A large uncontained spill affecting Alabama beaches could result in severe economic losses in the tourism and recreational industry. Details of the potential consequences affecting the Alabama Gulf coast are addressed in Chapter 6, while potential effects on Mississippi's coastal recreation industry are discussed below.

5.220 Coastal Mississippi is a major attraction to vacationers and outdoor enthusiasts. In 1980, travel and tourism was the fourth largest employer in the state and expenditures totaled over $1 billion (U.S. Governmental Affairs Policy Council, 1980). The Mississippi coast tourist trade is dominated by Harrison County with its 26 mile man-made beach; Harrison claims 85 percent of the local business. In all, more than 5,500 motel and hotel rooms are available along the coast. It has been estimated that for every dollar spent on lodging, two more are spent on related goods and services (Mississippi Department of Wildlife Conservation, Bureau of Marine Resources, 1982). Applying this multiplier to 1981 hotel/motel receipts, more than $140 million are attributed to commercial lodging alone. Annual visitation to Gulf Islands National Seashore exceeded 600,000 the same year, while the total annual value of receational marine fishing is over $43 million (Mississippi Department of Wildlife Conservation, Bureau of Marine Resources 1982).

5.221 An accident, particularly a major material spill, could severely affect the economy of the coastal area. A case in point is the blowout of the Mexican Well IXTOC-1 off Campeche which resulted in the degradation of beaches and economic losses for Padre Island (Texas) resort owners. Although the evidence of oil pollution in the area was limited to a few offshore birds, the mere presence of the oil was sufficient to cause tourists to avoid the area (U.S. Army Corps of Engineers, 1982b). It took over nine months to stop the source of the spill, estimated to be the world's largest. A 1980 economic damage assessment on recreation, tourism, and commercial fishing found subregional economic impacts amounting to about $3 million on the recreation sector and $4 million on tourism (U.S. Department of the Interior, 1983d). All detectable impacts were restricted to the year of the initial spill and did not extend into 1980 or 1981 (U.S. Department of the Interior, 1983d).

<u>Accidental Release to the Atmosphere of Natural Gas Containing Hydrogen Sulfide</u>

5.222 Effects of an accidental release of gas containing hydrogen sulfide would be the same as those described in Chapter 4.

PRODUCTION

5.223 During the production phase for an oil and gas field, the hydrocarbon resource is brought to the surface, collected in a gathering system and brought to shore, treated to remove impurities, and transported to an intermediate market. Certain activities must take place before the resource can flow through the system:

- Well Completion activities.
  - Stimulation or treatment of the geological formation (may not be needed)
  - Installation of wellbore and wellhead production equipment

- Construction activities.
  - Production platform
  - Pipeline gathering system
  - On-land hydrocarbon treatment facilities
  - System for transport to intermediate market

Once facility construction is completed, recovery of the resource begins. Maintenance, servicing and normal operating activities necessary during production include the following:

- Routine servicing and maintenance of the wells.
- Well workover.
- Pipeline inspection and repair.
- Servicing and maintenance of treatment facility.
- Disposal of liquid and solid wastes.
- Sale of treated hydrocarbon and some products recovered from the raw hydrocarbon stream.

A discussion of the production phase is given in Appendix A.

5.224 The effects of production activities that would take place within Mobile Bay and Mississippi Sound and adjacent wetlands are discussed below. Activities that would occur on adjacent uplands are discussed in Chapter 7.

Well Completion

5.225 Well completion involves treatment of the geological formation (if needed) with acids or liquids under high pressure to increase the flow of hydrocarbon, treatment of the well bore to ready it for production, and the installation of casing, tubing and wellhead flow regulating devices necessary to produce the hydrocarbon. The rig used to drill the well may be used for well completion or a smaller servicing rig brought in as a replacement.

Water Quality

5.226 Activities during well completion in Mobile Bay and Mississippi Sound are the same as in the Mobile River Delta. Impacts to surface waters would result from platform construction similar to that described earlier for a drilling platform construction and from boat and barge traffic in shallow waters.

Hydrology

5.227 If a rig smaller than the drill rig is utilized for well completion, localized circulation within a few hundred feet of the rig could revert back to some extent toward pre-development conditions. Barges and boats would affect circulation only for short time periods while they are in use.

Estuarine Ecosystems

5.228 If well completion is carried out with the rig used to drill the well, effects on the estuarine environment would be a continuation of those associated with the routine drilling operations. If the drilling rig is removed and replaced with a smaller rig, some temporary localized turbidity could result. The effect would be limited to the immediate well vicinity.

Groundwater

5.229 Impact to the groundwater resources from well completion in the Bay and Sound would basically be the same as those described for the Delta.

Wastewater Disposal

5.230 Wastewaters would continue to be handled in the same manner as during the drilling phase. No discharges to Mobile Bay or to Mississippi Sound are allowed from well sites. Runoff and other wastes from platforms would be transported to an approved upland site for treatment and disposal. Discharges from marine vessels are allowed in accordance with U.S. Coast Guard regulations.

Air Emissions

5.231 Air emissions resulting from production activities are shown in Table 5-3.

Noise

5.232 Well completion procedures are similar to those described for the Delta (logging, cement plugging, casing, cleaning, and perforating). However, procedures are more complicated for an offshore drilling site since supply vessels and crewboats (Chapter 4) or helicopters (70-90 dB at 1000 feet: New England River Basin Commission, 1976) are required, as opposed to land vehicles or motorboats/crewboats for inshore wells.

Solid and Hazardous Wastes

5.233 Well completion activities will be essentially the same as in the Delta. Waste products typical of these activities include treatment chemicals, crude oil and formation fluids. Normally, these materials are handled separately from other drilling wastes and are treated prior to disposal. After treatment, formation fluids are usually reinjected into safe formations while the oils are retained and solids are disposed of onshore in approved facilities.

Socieconomic Characteristics

5.234 Completion and production service companies provide operators with special equipment and services after the well is drilled. This phase is one of the busiest during well development. Experience in the area indicates that between 8 and 15 individuals would be added to the normal rig personnel of 20-36 at any one time during completion. The procedures used to complete a well are dictated by formations and down-hole characteristics, not the location of a well relative to local communities; thus the potential effects generated by well completion in the Bay and Sound are essentially the same as those described for the Delta (Chapter 4). Traffic would increase at the staging areas as personnel and materials are ferried to the rig. Additional tugs could be necessary for the increased number of barges; but a nearby business could be used. If crew members lived in the coastal counties, wages would be taxed by state and local governments. Personnel residing out of the vicinity would have little interaction with the local economy.

Navigation

5.235 The waterway traffic that would occur due to well completion activities would primarily consist of crew boat and supply barge movements. Crew boat movements would generally be 3 per day. An additional 2 or 3 trips may be required on a given day for company personnel involved in the treatment operations. The delivery of formation treatment liquids and the removal of waste material would probably require, at most, 2 barge round trips a day. The exact frequency would depend on the volume of treatment material to be used.

Production Platform Installation

5.236 After well completion, the well could be temporarily shut-in (temporary abandonment), or a production platform could be erected. A commonly used platform in the United States has a steel framework made of tubular steel which is welded together (Clark et al., 1978). These structures are built in units at onshore facilities. When complete, the supporting frames, or jackets, are rolled onto dollies or reels, then onto a barge for transportation to the installation site. The deck section is composed of modular units that can be attached. Pipe and other surface equipment may be constructed at different facilities from the jacket. They too are subsequently barged to the site (New England River Basin Commission, 1976). Once the jacket is on location, one or two derrick barges are used to put the structure in place.

5.237 Site preparation would require about 20 people per platform, 10 of whom could be local (U.S. Army Corps of Engineers, 1982a). Installation of one platform could take about a month, with a total workforce of 80 split into two crews of 40. Five of these individuals could be locally based. Daily shift changes would not occur if the crew lived on the barge. The home base would probably be a major port such as New Orleans.

5.238 Personnel who did not already live in the area would not interact with the local economy, services and the like. Effects generated by platform installation in the Bay or Sound would be minimal at most if a non-local business were awarded the contract. If a nearby staging area had to be established, about 25 onshore jobs could be created per platform; half of these could be filled from the local labor force (New England River Basin Commission, 1976). In this case, the area would benefit from wages, taxes, and private purchases. The 1983 weekly median earning of those in the construction trades (excluding supervisors) was about $360. Assuming this wage, about $9000 per week could be earned, taxed and circulated in the area (U.S. Department of Labor, 1983).

5.239 To install the production equipment on the platforms a workforce of about 40 people (including about 5 locals) would be needed for over six months. Two crews would work a 7 day, 12 hour per day shift. At a minimum these individuals could collectively earn over $14,000 per week, under the assumption they are paid the weekly average of the construction trade. It is likely that the more specialized jobs would be paid more. Each evening the employees would return to shore. There would be an increase of about 20 vehicles driven to and from the staging area on a daily basis. An additional crewboat would also be needed to ferry the crews to the platforms. It has been estimated that 1 to 2 supply trucks per day would be needed for deliveries. Other than traffic increases in and around the staging area, the only expected effect would come from minor purchases of food and fuel made by workers enroute to and from their job. If a platform were designed to house a crew offshore, quarters would be installed either on a production platform, or on a separate offshore structure designed for the purpose. In this case, the time required for platform and equipment installation would be lengthened.

5.240 Platform installation would require the use of tugs with barges for delivery of the platform sub-assemblies and the platform equipment, one or two derrick barges, crew boats for shift changes, and supply boats for delivering material to the platform.

5.241 Some turbidity would be produced at the construction site from placement of the jacket and from propwash of vessels. Turbidity would be localized and any effects would be limited to the platform vicinity. Noise, air quality, and solid waste impacts would be similar to those described for construction of a fixed drilling platform, but of less intensity.

Gathering System Construction in Estuarine Ecosystems

5.242 A pipeline gathering system must be constructed to transport the hydrocarbons from the well surface locations within a field to the on-land treatment facility. Within Mobile Bay and Mississippi Sound, it is likely that gathering pipelines would be laid from each surface well site to a central gathering platform from which a single trunk line to the upland treatment facility would be used. A typical system might consist of one or two production lines, one or two spare production lines, corrosion inhibitor circulation lines (if needed for gas containing hydrogen sulfide) and a fuel gas line for platform equipment.

5.243 In Mobile Bay and Mississippi Sound the pipeline gathering system would be buried in a trench. Typical dimensions would be as follows:

- o 5 to 7 feet deep, 100 feet wide trench.
- o 100 feet wide dredged material storage area adjacent to trench.
- o Navigation channel crossing requires 10 feet minimum depth over top of largest pipe.

5.244 A bucket-type dredge would probably be used to excavate the trench and the pipe system would be installed from barges following the bucket dredge. Hydrotesting of the pipeline would be carried out and the trench backfilled using a dragline. Shell or gravel would be added to areas subject to scour to keep the lines from becoming exposed.

5.245 The elapsed time from trench excavation to refilling would depend on segment length. In general, trench refilling is not undertaken until hydrotesting is completed. The trench could remain open for as little as 1 month to as long as 6 to 8 months.

Water Quality

5.246 The type of impacts would be the same as for the bucket and hydraulic dredge. More sediment may be resuspended if the pipe

is installed by hydrojetting because the jet pressure placed on the sediments promotes resuspension more than mechanical forces from other types of dredging equipment. Open trenches would affect surface water quality and hydrology similar to the navigation channels discussed previously. During pipeline burial operations, large volumes of bottom sediments may be suspended with turbidity increases lasting up to a few weeks (U.S. Department of the Interior, 1983g).

Hydrology

5.247 Pipeline trenches along the bottom of Mobile Bay or Mississippi Sound would alter circulation in bottom waters within a few feet of the trench. Once pipelines are installed and trenches are backfilled to original grades, circulation may not be affected. Short-term, localized changes in circulation due to dredging and pipeline transport would also take place.

Aquatic Ecosystems

5.248 Aquatic ecosystems could be affected by gathering system construction through direct destruction and burial of benthic organisms and from turbidity and pollutants resulting from resuspension of sediments. These effects would be similar to those discussed in the drilling section for channel dredging for inland drilling barge access to salt marsh site.

5.249 Loss of Benthic Habitat. Benthic organisms on about 4.6 acres per 1000 feet of pipeline corridor would be destroyed directly within the trench and material storage area. This area would be lost as feeding, spawning and nursery area for many aquatic species during the construction period. The backfilling operation would destroy any organisms that recolonized the area after dredging took place.

5.250 Effects of Turbidity. Turbidity resulting from dredging and backfilling would affect benthic communities adjacent to the excavation area. If physical burial is not too great benthic communities should recover quickly once turbidity decreases to normal concentrations (Anderlini et al., 1975; Conner, 1977).

5.251 Larger motile estuarine animals, such as shrimp, crabs, and fish would not be directly affected to any great extent by the resuspended sediments from laying the pipeline because they would avoid areas of high turbidities. In general, concentrations of suspended sediments must reach very high levels (several grams per liter) before clogging of gills and opercular cavities can cause suffocation in fish. These concentrations are unlikely to be

reached during pipeline construction. Furthermore, fish can usually clear their gills of silt upon entering clearer water.

5.252 Resuspension of sediments accompanied by unusual conditions such as acidic or alkaline compounds or other substances that can injure or impair gill function could lower the concentration threshold at which fish and motile invertebrates could be affected (Huet, 1965; Stickney, 1973; May, 1973b). Based on experience with the considerable amount of dredging that has taken place in Mobile Bay in the past, it is unlikely that such conditions would occur during construction of the pipeline.

5.253 Effects on Seagrass Beds. If a pipeline was constructed through a seagrass bed, vegetation would be destroyed within the trench and dredged material storage area for the construction period. Redeposition of suspended sediments would also bury some adjacent vegetated area. This loss would be more significant than loss of other habitat types because of the relatively small area of this community type in Mobile Bay and Mississippi Sound and its ecological importance to the estuarine ecosystem.

5.254 Effects on Oyster Reefs. Pipelines passing through oyster reefs would result in the direct destruction for the period of construction of reef area within trench and dredged material deposition area. Turbidity and redeposition of suspended sediments could affect adjacent reef area as well (see discussion on channel dredging for inland barge rigs).

Wastewater Disposal

5.255 Management of sanitary wastewaters and other liquid wastes would be the same as for well completion and all drilling alternatives for the Bay and Sound. Wastewaters and runoff from platforms would be stored in barges and periodically hauled to a sewer line or directly to a wastewater treatment plant for treatment and disposal.

Air Emissions

5.256 Air emissions resulting from gathering system activities are shown in Table 5-3.

Noise

5.257 In estuarine and marine ecosystems dredge barges are employed to bury the pipeline. Bury (jet) barges used in jetting which is the most common pipe trenching technique (Golden, et al., 1980), are tug-assisted for propulsion and have one or more

engines. Jet barges that are appropriate for shallow embayments may use a relatively small 250-horsepower pump (e.g., GM8V71). Tug boat noise levels may be comparable to data given in Chapter 4 and engine data would be similar to small Caterpillar Tractor engines listed for the Delta (noise levels of presented models and brands may or may not be comparable). Other noise generated during pipe layings, stringing, and welding may be similar to conventional onshore methods (in terms of noise) presented in Chapter 4.

Solid and Hazardous Wastes

5.258 Wastes generated by this activity would be limited to that produced by crew boats. Wastes are contained on board and properly disposed of in harbor. All dredge material remains in place.

Socioeconomic Characteristics

5.259 Gathering line construction requires a relatively large workforce and a nearby shore based staging area. Right-of-way acquisition for landfalls can result in an influx of money to a locality.

5.260 It has been estimated that about 120 workers would be needed for several months to lay a five line system from producing formations in Mobile Bay to the proposed Mobile County landfall. Ten of these employees could come from the local area. Non-local personnel are likely to be based near Houston or New Orleans where the major contractor would probably be established (Mobil Oil Exploration and Producing Southeast Inc., 1981b).

5.261 Two tours of sixty members each would be used. They would serve a seven day tour. Crew changes would be made at the operator's local staging area (U.S. Army Corps of Engineers, 1982a). Auto traffic increases would result, but they would mostly occur once a week. Non-local employees would be likely to participate in the local economy through minor purchases of food and gas en route to and from work. Beyond this contribution, little if any effect would be felt from the installation of the offshore portion of the pipe. Construction activity is temporary, reducing the duration of any effects.

5.261a Recent costs for an 8-inch offshore pipeline near Louisiana amounted to almost $1.9 million per mile (Seaton, 1983). About 60% of the total cost was paid for labor, 17% was spent for materials, another 20% went for engineering, surveying, administrative, overhead and other miscellaneous expenditures while the remainder was used for the rights-of-way and damages (Seaton,

1983). A multi-pipe pipeline offshore Alabama could be expected to cost more, but even at a minimum the region could experience an economic boost. The magnitude of the effect locally, however, would depend on the origin of workers, and the location of material purchases.

5.262 Staging areas for offshore pipelaying could be developed at any of the areas ports including Mobile, Bayou La Batre, Pascagoula, Gulfport and Bay St. Louis. The selection of a staging area would be based on available space and distance from the operation.

Navigation

5.263 Gathering system construction activities cross open water areas between platforms and between a central gathering platform and the land. Such activities could interfere with local waterway traffic. However, most existing traffic is confined to the maintained north-south navigation channels going up Mobile Bay and crossing Mississippi Sound and the Intracoastal Waterway crossing the lower Bay and the Sound from east to west. For an existing drilling activity in the Bay, the gathering line is planned to be bored under the main Mobile Bay channel and trenched across the Intracoastal Waterway (U.S. Army Corps of Engineers, 1982a). It would be expected that any future gathering line crossings of major channels (that is, channels within designated safety fairways) would be by boring and not trenching so that navigational impacts would be minimal. Similarly, the Intracoastal Waterway would most likely be crossed by trenching. Although this involves activity directly in the navigation channel, the relatively small size of this channel (125 feet vs 400 feet for the Mobile Bay Ship Channel) would not require lengthy interference, probably averaging only a half day.

5.264 Material dredged from the pipeline trench would be stored adjacent to the trench until backfilling is carried out. The height of the material pile would be 1 to 4 feet depending on how much slumping occurs. Since pipeline segments near the landfall would be in water 6 feet deep or less, the material pile could be a hazard to small craft navigation in that area. The rest of the pipeline segment from shore to an auxiliary platform would be constructed in water up to 15 feet deep. In these deeper areas the material piles should not pose a hazard to navigation.

Gathering System Construction in Wetlands

5.265 Salt marsh wetlands, consisting mostly of *Spartina* and *Juncus*, occur along portions of the Mobile Bay and Mississippi Sound shoreline (see Chapter 3). Forested wetlands also occur in the

coastal area. Gathering pipeline systems may cross these areas enroute to the upland treatment plant site.

Water Quality

5.266 Gathering systems constructed in wetlands would have the same types of impacts as discussed previously for the Mobile River Delta. The impacts due to open trenches in the wetlands would be the same as for an access canal in a salt marsh. These impacts include some loss in the ability of the wetland as a whole to maintain favorable water quality conditions. Duration of these impacts depends upon the time needed for the pipeline trench to revegetate by naturally-occurring processes.

Hydrology

5.267 Creation of pipeline trenches in trenches that are hydraulically connected to the Bay or Sound would allow tidal flows of saline waters to be pushed further into the wetland during flood tides. The effects would be the same as discussed for a canal and slip in a salt marsh; water velocities and water levels would be higher than if the trench was not present. However, unlike a canal and slip, a pipeline trench could be backfilled once the pipelines are installed, so effects of pipeline trenches are relatively short-term.

Wetland Ecosystems

5.268 The wetland area affected would be similar to a wetland gathering system in the Delta. For a 3 to 5 pipe gathering system, the salt marsh area disturbed by the pipe ditch and equipmentworking area would be about 3 acres per 1000 feet. This assumes a 40-foot width for each right-of-way component: excavated trench, work area, and dredged material stockpile area (U.S. Army Corps of Engineers, 1982a). About 1 acre of this would be the excavated pipe ditch, the remainder would be the work area and dredged material stockpile area.

Wastewater Disposal

5.269 Management of wastewaters would be the same as discussed for pipelines installed in Mobile Bay or Mississippi Sound. The no discharge rule applies to well sites in wetlands as well as to the Bay and Sound.

Air Emissions

5.270 Air emissions resluting from these activities are shown in Table 5-3.

Noise

5.271 Noise emanating from pipeline construction in wetlands is described in Chapter 4.

Solid and Hazardous Wastes

5.272 Wastes generated by this activity are minimal and limited to crewboat waste. All dredged material is left in place.

Socioeconomic Characteristics

5.273 Estimated peak employment for a five line system would be about 100, 60 of whom could come from the local workforce (U.S. Army Corps of Engineers, 1982a). The local hires, retail businesses and area governments would benefit. Wages would be circulated in the local economy, taxes collected, and revenues could be generated by renting or leasing space for a staging ground.

Gathering System Construction Across Barrier Islands

5.273a Some pipelines from production platforms in the Gulf of Mexico to onshore treatment plants could cross barrier islands in the study area rather than through the inlets. Two methods could be used. One would be the trench and cover method. The other would be the horizontal boring method.

5.273b The barrier land forms in the region include the Fort Morgan Peninsula and Dauphin Island in Alabama, and Petit Bois, Horn Ship, and Cat Island, all in Mississippi. The Fort Morgan Peninsula and the eastern end of Dauphin Island are developed with residential and commercial structures, while the western end of Dauphin Island and the Mississippi barrier islands are mostly undeveloped. Horn, Petit Bois, and Ship Islands are part of the Gulf Islands National Seashore. Horn and Petit Bois Islands are designated wilderness areas.

5.273c The Gulf Islands National Seashore, as part of the National Park System, would fall under regulatory control regarding pipeline crossings and rights-of-way easements (CFR 36 Part 9 Subpart B and Part 14).

5.273d An applicant would initially comply with the right-of-way acquisition process established in Part 14, which could include reimbursement for costs associated with preparation of reports pursuant to the National Envionmental Polity Act (42 U.S.C. 4321-4347.

5.273e If a right-of-way were granted then the operator would have to prepare and file an Operations Plan (Part 9). The Plan of Operations must contain numerous specified details (Part 9.36) including the anticipated direct and indirect effects from the action on the natural, cultural, social and economic environment, and measures to mitigate adverse consequences. The Regional Director would not approve a plan where

> "... operations would substantially interfere with management of the unit to ensure the preservation of its natural and ecological integrity in perpetuity..."

5.273f An environmental analysis of the plan would be conducted by the Regional Director and the operator would be notified within 60 days that the plan is approved, rejected or if further time and analysis is required. The Director may decide, in this procedure, that documents under the National Environmental Policy Act need to be prepared.

5.273g If an Operations Plan to construct a pipeline is approved Operating Standards would apply including the stipulation that surface operations cannot be conducted within 500 feet of mean high tide line (Part 9.41).

Trench and Cover Construction

5.273h Use of the trench and cover method to cross a barrier island would involve the digging of a trench across the island, placement of the pipe into the trench, and refilling of the trench with the excavated material. Standard offshore pipeline construction techniques would be used approaching the Gulf of Mexico side of the island into about 8 to 10 feet of water (see Chapter 6). Trenching in the shallow surf zone and the beach would be accomplished with an amphibious clamshell dredge or backhoe similar to a marsh buggy or by a spider jack-up walking platform (Mouselli and Pospishil, 1984). Trenching across the upland portion of the island and the wetland on the Mississippi Sound side would probably be done using tracked wetland types of equipment.

5.273i Lack of road access to the construction site in much of the study region may limit the methods available for placement of the pipe in the trench. From the Sound and Gulf sides, the push method could be used to float the pipe into the trench from an assembly barge offshore. On the upland portion of the trench conventional wetland techniques and equipment could be used if enough equipment could be landed on the island. If this is not possible, pipeline sections could be prepared offshore, floated into

shallow water, picked up by amphibious crane and placed in the trench for welding and coating of the joints.

5.273j Only the effects of crossing the surf zone, beach and upland portions of the barrier island are discussed below. The effects of crossing saltmarsh wetlands is described beginning at paragraph 5.265. The effects of pipeline construction in estuarine areas is described beginning at paragraph 5.242.

5.273k Water Quality. Surface water in the surf zone would be affected to a brief minor degree during trenching across the zone and during refilling of the trench. Because of the predominantly sand-sized material, turbidity should be slight and limited in extent.

5.273l To the extent that the trench penetrates the island at sea level, there is a possibility of salt water intrusion into the island freshwater aquifer. Sand deposits on Dauphin Island and most of the Fort Morgan peninsula are a source of ground water for many domestic wells and a few public supply wells (Alabama Coastal Area Board, 1980). Leaving a plug of material in the trench is a common method to reduce or eliminate this potential problem.

5.273m Hydrology. Only brief, localized effects on hydrology would result from the trenching operation in the surf zone. If the dune lines are not restored after pipeline construction, the possibility would exist for breaching of the island and possible uncovering of the pipeline by large storms and hurricanes, since the dunes act as physical barriers to storm waves. If the dunes are restored to the original contours and stabilized with snow fencing and sea oats or other appropriate vegetation, the possibility of breaching could be greatly reduced.

5.273n Aquatic Ecosystems. All benthic organisms would be destroyed within the trench and dredged material storage area in the surf zone and beach area. Refilling of the trench would occur within a few days. Because this area is a highly dynamic current and sediment system, recolonization by benthic organisms carried into the disturbed area would be very rapid.

5.273o Upland Ecosystems. All vegetation would be destroyed along the pipeline right-of-way, which could be from 35 feet to 75 feet wide depending on the size of the pipeline and the type of equipment used for construction. Affected could be the dune community of sea oats, dune panic grass, salt grass, pennywort and seaside morning; the overwash community of seaside goldenrod, beach heather, milkweed, seaside rosemary and saw palmetto; and (where it occurs) the maritime forest community of grasses, shrubs and trees.

Recovery of these areas could depend on several factors. For example, wind movement of the sand could greatly slow the natural revegetation process. Stabilization of the rebuilt dunes with snow fencing and planting of dune vegetation could result in rapid recovery. Regrowth of the maritime forest, if affected, would not occur since the pipeline corridor would be maintained free of larger woody vegetation as long as the pipeline was in use.

5.273p Threatened and Endangered Species. Trenching across the beach zone could destroy sea turtle nests within the corridor. Sea turtles have nested on the barrier islands in the past. While it is not known if nesting still takes place, the habitat still exists.

5.273q Wastewater Disposal. Sanitary wastewater and other liquid wastes from vessels supporting the pipelaying operation would be disposed of in accordance with regulations for such wastes.

5.273r Air Emissions. Air emissions would be similar to those given for upland (Chapter 7), wetland (Table 5-3), and estuarine pipeline construction (Table 5-3).

5.273s Noise. Noise resulting from construction activities would be similar to that described for wetland construction in the Delta (Chapter 4).

5.273t Solid and Hazardous Wastes. All solid wastes would be removed from the site. Vessel wastes would be disposed of in harbor. All dredged material is returned to the trench.

5.273u Socioeconomic Characteristics. Construction labor requirements would be similar to that for wetland construction described in Chapter 4.

5.273v Navigation. Barrier island construction should have no effect on navigation.

Horizontal Drilling

5.273w Horizontal drilling methods like those described for river crossings in the Mobile Delta (Chapter 4) could be used for crossing barrier islands. Two methods could be used. Where road access would be available the drilling rig could be placed on the island. Boring could be carried out towards the Gulf and/or Mississippi Sound or Mobile Bay, the borehole coming up in water deep enough to continue with offshore pipelaying methods. Another method where the barrier island is narrow enough would be to place the drilling on a barge and bore completely under the island.

5.273x Most of the effects associated with the boring method would be the same as described for river crossings in Chapter 4. Therefore, the following discussion is only concerned with those things that would be different for crossing of barrier islands.

5.273y Water Quality. When drilling from a barge, all drilling wastes at the barge would be contained for disposal onshore. Some drilling fluid would be lost into the water when the drill string breaks out of the ground at the exit site. At the present time, the drilling mud used would be bentonite clay and water. Loss of the small volume of material would result in some brief localized turbidity.

5.273z A potential would exist for saltwater intrusion along the borehole into any freshwater aquifer underlying a barrier island until casing was emplaced. The arc-shaped borehole route could be deep enough to pass under any shallow surface aquifer. If a deep aquifer existed, penetration by the borehole could occur.

5.273aa Hydrology. Use of the boring method would have a negligible effect on groundwater.

5.273bb Aquatic Ecosystems. The benthic community at the drilling could receive some disturbance from propwash of service vessels and from drilling site preparation. Some local disturbance would occur from the lost drilling fluid at the borehole exit site. Additional disturbance at this site would be those associated with Gulf or estuarine pipelaying methods that would begin at this point.

5.273cc Upland Ecosystems. About 1/2 acre would be required for the drilling rig site. Additionally, a board road may be required to reach the site from the nearest access road. Recovery of these areas after completion of drilling activities would be as described for the trench and cover method above.

Normal Operations of Wells and Pipeline Gathering Systems

5.274 Once construction of production facilities is completed, flow of the hydrocarbon resource through the system commences. Production may last from just a few years for a small field to decades for a large one. Effects and activities associated with normal operations include the continuation of some habitat disruptions, release of emissions to the air, disposal of wastewaters and other process byproducts, the expenditure of money locally for wages, goods and services, and the payment of royalties to the state.

Water Quality

5.275 Activities during normal operations of the production phase are the same as in the Mobile River Delta. Surface water quality impacts would be limited to engine exhaust and resuspended sediments from boat traffic in shallow water.

Hydrology

5.276 Rigs, barges, boats and any changes in soil or sediment locations due to dredging at the rig would continue to affect local water circulation and water levels. However, these effects would only be evident within a few hundred feet of the locations affected by hydrocarbon production activities. As pipeline right-of-ways in wetlands are managed, effects on hydrology are controllable by allowing vegetation to recover to natural conditions.

Estuarine Ecosystems

5.277 Estuarine ecosystems disturbed by construction activities would recover over time. No new disturbances would occur to benthic communities along pipeline corridors during normal operation. Some localized turbidity and benthic disturbance could occur from service vessel propwash at the wellsite depending on the depth of water.

5.278 Recovery of Benthic Community. Recolonization of the disturbed sediments by settling of planktonic larvae of benthic organisms within the Bay should require from 6 to 18 months (Pfitzenmeyer, 1970; Saila et al., 1972; Taylor, 1972; May, 1973b; Conner, 1977; Rhoads et al., 1978; Hirsch et al., in preparation). Factors that would affect the rate of recovery include the rate of dewatering of the material replaced into the trench, changes in the local bathymetry in the pipeline corridor, and changes in the sediment composition within the corridor. Studies in Mobile Bay have found that up to nine months are required to dewater and consolidate dredge material from hydraulic dredging operations (Brett, 1975). Until dewatering is near completion, it is possible that recolonization could proceed slowly.

5.279 The uneven bathymetry produced by refilling the gathering system trench could somewhat alter the pattern of recolonization. The results of recent bathymetric studies in central Mobile Bay indicate that bottom irregularities produced by dredging of commercial oyster shells can remain for fairly long periods.

5.280 In Mobile Bay, a factor influencing the rate of recolonization of the pipeline corridor could be oxygen conditions during the period of recovery. Since the area is subject to periods of low dissolved oxygen concentrations during the warmer months (May, 1973a), the rate of recolonization could be reduced until more favorable conditions prevailed.

5.280a Recovery of Oyster Reefs. Any reef area within the trench and dredged material storage area would have been destroyed by construction activities. Additional reef area adjacent to the construction area could have received a layer of sediment as suspended material settled out of the water. Placement of new shell material would be required for any recovery of these areas to occur. New shell material would be colonized by natural spat setting. Recovery time could vary depending on natural year-to-year variations spawning success, spat set survival, salinity and water temperature at the site, but would probably be complete within 3 to 4 years. Planting of spat could increase the recovery rate somewhat.

5.280b Recovery of Submersed Aquatic Vegetation. If any submersed aquatic vegetation beds were crossed by a pipeline, all vegetation within the trench and dredged material storage area would have been destroyed by construction activities. Additional vegetation area adjacent to the construction area could have received a layer of sediment as suspended material settled out of the water. The rate of natural recovery of the disturbed area could vary considerably depending on sediment characteristics of the disturbed area, current energy, salinity variations, and weather extremes. Natural revegetation by seeds is slow. For example, turtle grass (Thallasia testudium) can require up to 50 years for natural recovery to take place (Thorhaug, 1976), if it occurs at all.

5.280c The rate of natural recovery of submersed aquatic vegetation can be increased by replanting although replanting is not always successful. "Plugging" of seedlings has been successfully demonstrated for a number of areas and for a variety of seagrass species. Turtle grass (Thallasia) replanting has been well documented (Thorhaug, 1976, 1979; McLaughlin et al.). If replanted, recovery can be up to 80 percent in 4 to 8 years. Mollusks, fish and pink shrimp returned to replanted areas.

5.280d Thorhaug (1976) also reports that Syringodium is amenable to plugging restoration and recolonized rapidly in 3 to 4 years. Eleuterius (1974) and Phillips et al. (1978) report successful replanting of bay bottoms with shoal grass (Halodule wrightii). Eleuterius (1974) stated that shoal grass has the greatest roots and rhizomes with fast growth in Mississippi Sound. Eleuterius (1984) reports that replanting of Halodule was most successful in the field when the rhizomes were anchored with

construction mesh. Recovery was almost 100 percent within a few years. Benthic fauna also recolonized the grassbeds. Zimmermann et al. (1981) reported a 100 percent survival in the lab for Halodule with the addition of a 0.5 percent NAPH (root stimulant) and only a 73 percent survival after eight months. However, a replanting project in Florida (Phillips et al., 1978) only survived 13 months due to natural weather extremes that occurred during this period. Eleuterius (1984) suggests that replanting may be necessary in such cases.

Salt Marsh Wetlands

5.281 Salt marsh wetlands within the area of channels dredged for drilling barge access and under adjacent disposal areas would continue to be lost for the duration of the life of the well sites since the channels must remain open to allow access for well workover rigs during the production period. Wetland values and functions of these areas would continue to be lost. This loss could last from several years to decades depending on the quantity of hydrocarbon available at the site.

5.282 Recovery of pipeline corridors would begin as soon as the trench is refilled. A number of factors would affect the rate and success of recovery. These include the elevation of the surface of the refilled trench and whether or not the area is replanted.

5.283 Compaction and dewatering of stored material while the trench is open could reduce the volume of material sufficiently so that the trench could not be refilled completely. If the remaining depression remaining is deep enough, conditions may inhibit or prevent the natural recolonization of vegetation.

5.284 If the trench is returned to preproject elevations, natural recolonization by salt marsh vegetation could occur within 2 to 5 years (U.S. Army Engineer Environmental Laboratory, 1978). If sprigs of vegetation are transplanted to the site, recolonization could be more rapid (Thorhaug, 1976; Allen et al., 1978; Cammen, 1976). Wetland values within the pipeline corridor would be reduced until the area recovered.

Forested Wetlands

5.285 Vegetation on pipeline corridors within forested wetlands would be maintained in any early successional state of grasses and small woody shrubs. Primary production would be reduced and value as wildlife habitat altered for the period of operation of the pipeline (see Chapter 4).

Wastewater Disposal

5.286 During hydrocarbon production, formation waters need to be managed in addition to sanitary wastewaters, runoff, boat wastes and liquid chemicals. Formation waters can often be reinjected at the well site. Otherwise, formation waters can be transported to an upland processing facility for separation and disposal. As always, methods to manage all wastewaters must be approved by the appropriate state agency.

Solid and Hazardous Wastes

5.287 Well servicing operations in shallow water typically rely on service barges or light jack-up rigs. Each well location may require casing, cementing, logging, perforating, fracturing, and chemical treatment. Solid wastes produced are normally minimal and may consist of cements, trash, sanitary wastes, and a small volume of treatment chemicals or acids. The potential for accidental spills or leaks of these solvents, acids, and detergents into the marine environment does exist.

5.288 Routine maintenance of gathering systems may also be required. Pipe cleaning operations and repairs may result in small hydrocarbon spills.

Air Emissions

5.289 Air emissions from associated activities are shown in Table 5-3.

Noise

5.290 In terms of noise, the normal operation of wells and gathering systems in the Mobile Bay and Mississippi Sound area would generally be similar to operations in the Mobile River Delta. Activities such as gas valve releases and blowdowns would occur at the wellhead and the onshore pipeline gathering station. Maintenance of submerged pipelines in the estuary or further offshore would be more complicated than onshore maintenance in the Delta uplands (due to the need for crewboats, which would also add noise) but would be similar to the wetlands/marsh area.

Socioeconomic Characteristics

5.291 Employment opportunities drop significantly once wells and pipelines are operational. Daily well monitoring requires an average of 10 individuals; generally these people are oil company employees (Wales et al., 1976).

5.292 Depending on distance and economy, the production platform crews would live on the offshore structure or on land. If onshore residency were employed the crew would be shuttled to and from their work on a daily basis (Johnson, 1983. Personal communication). Some transfers of personnel to the local area could result. Offshore crews would be housed on the main platform or a nearby quarters platform and serve tours similar to those on drilling rigs. Employees could opt to move to the local vicinity, or maintain a home base elsewhere in the Gulf Coastal region. Those who move to the area would interact with the local economy on a daily basis. Those who commute could make minor retail purchases, but their influence would be minimal.

5.293 Normal pipeline operations are highly automated. At most a small crew would inspect and repair the system periodically (see Chapter 4).

5.294 Once hydrocarbons are extracted, their value is subject to state taxes. The State of Mississippi imposes a 6 percent severance tax on the gross value of oil and gas at the wellhead. In addition, the State Oil and a Gas Board imposes a maintenance tax amounting to 2 cent per barrel of oil and 0.2 cent for 1,000 cubic feet of gas (Bell, 1983. Personal communication). Once a well goes into production the state can begin to collect these taxes and offshore a 20 percent royalty. The dollar amount received in revenues depends on the amount of the resources, the rate of extraction and market conditions.

5.294a At $30 per barrel, Mississippi could collect $1.80 as severance tax in addition to 2¢ for the maintenance tax for each barrel of oil. Gas, valued at $3.45 per million Btu's (MMBtu) could yield 21¢ in severance tax for each 1,000 cubic feet produced in addition to 0.2 cent in maintenance tax. A royalty of 20 percent for offshore resources would earn the state an additional $6.00 for each $30 barrel of oil and about 70¢ for each 1,000 cubic feet of gas valued at $3.45/MMBtu.

5.294b Offshore resources, produced at depths greater than 18,000 feet below mean sea level in the State of Alabama are taxed at 8 percent. Thus a $30 barrel of oil could earn $2.40 for the state in severance taxes and $7.50 in royalties (at 25%). Each 1,000 of gas (at 3.45/MMBtu) could earn 28¢ in taxes and 86¢ in royalties.

Well Workover

5.295 At intervals throughout the life of a well, it may be necessary to carry out well workover services to increase production

from the well. In Mobile Bay and Mississippi Sound, well workover may be accomplished with a workover rig placed on the production platform at the well site or by a barge, jackup or submersible drilling rig similar to that used to drill the original well. Activities at the site during well workover could be of a comparable magnitude to the original drilling phase. Workover may require several weeks to complete. The site would be serviced by boat and barge. Contaminated wastewater and fluids would be collected in barges and disposed of onshore.

Water Quality

5.296 Workover activities in Mobile Bay or Mississippi Sound would be the same as in the Mobile Bay Delta. A workover rig may be placed on the production platform or a separate barge, jack-up or submersible drilling rig can be used. Workover activities could take several weeks to complete and would cause the same impacts as routine operations in the drilling phase.

Hydrology

5.297 As for the Delta, well workover is not expected to affect water circulation and water levels except for short-term effects of boats and barges.

Estuarine Ecosystems

5.298 If well workover is accomplished from the production platform, no additional disturbance would occur to the estuarine ecosystem. If barge, jackup or submersible rigs are used, the effects would be similar to those described for the drilling phase.

Wetland Ecosystems

5.299 No additional effects would occur to wetland ecosystems.

Groundwater

5.300 Impacts to groundwater resources from well workover would be similar to those described for drilling in the Delta, but of lesser intensity due to the reduced level of activity.

Wastewater Disposal

5.301 Management of sanitary wastewaters and other liquid wastes is the same as discussed for well completion. The no-discharge rule applies for well sites in the Bay, Sound and wetlands.

Air Emissions

5.302 Air emissions for well workover are shown in Table 5-3.

Noise

5.303 Well workover procedures for Mobile Bay and Mississippi Sound well sites would be similar to those in the Delta. Logistical problems such as site access would be considerably greater in the Bay and Sound compared to the Delta. In terms of noise, offshore activities would involve substantial crewboats and longer periods of tug boat assistance for workover barges (see Chapter 4), resulting in longer periods of noise generation.

Solid and Hazardous Wastes

5.304 Well workover activities in shallow marine environments normally require a barge rig or a small jack-up rig. Offshore wells will require barges for the disposal of waste materials such as cements, sanitary wastes, chemicals, drill muds and cuttings, and trash. Otherwise, well workover activities are very similar to those described for the Delta.

Socioeconomic Characteristics

5.305 Effects from well workover in the Bay and Sound would be the same as those described for the Delta. Differences would lie in the communities potentially affected, and the location of staging areas. Potential support bases along the Mississippi coast are listed under the section on drilling in this chapter.

Navigation

5.306 Waterway traffic due to well workover operations would include a mobile workover rig, crew boat, and supply barges. During the workover period, the workover rig would make one round trip to the production location from its port of origin and the tug bringing the rig would return to its home port on delivery and a second tug would be used to remove the workover rig. Crew boats could make from 1 to 3 trips a day between the work area and local staging area for delivering and returning special service personnel. The main workover crew would stay at the rig as on a drilling job with crew changes on a weekly basis. The delivery of supplies and the removal of waste materials could require approximately one barge trip per day at maximum activity levels.

Cultural Resources

5.307 The potential impacts to the cultural resources of the area due to production operations are similar to those impacts associated with drilling operations. It is expected that the District will require that a cultural resources survey as described for drilling activities be performed prior to any production activities. Any production activity that produces surface disturbances has the potential for impacting historical or archaeological sites. In production operations, this activity basically includes the installation of a gathering line system.

Commercial Fisheries

5.308 The potential for impacts to area commercial fisheries due to production activities would be essentially the same as the potential impacts due to drilling operations: direct loss of fishing area, interference with fishing operations, and space competition between fishing fleet vessels and oil rig vessels. The one new activity, gathering line construction, could produce impacts due to placement of the line or to the operations of a barge installing the line. The dredging of the pipe trench would disturb about 4 1/2 acres of bottom habitat per 1000 feet of pipeline corridor for the pipe trench and dredged material storage area. The extent of this impact would depend on the type of bottom being disturbed: open bottom, seagrass beds, or oyster reefs. The turbidity generated during dredging operations could affect oysters that might be in the areas adjacent to the dredging. Irregularities or mud lumps on the bottom following pipeline installation could affect trawling operations by increasing the load on trawling nets and causing the nets to be ripped or lost. The operations of the pipe laying barge should not interfere with fishing vessels crossing the area as they proceed to and from their home ports.

Spills of Toxic or Hazardous Material

5.309 During production, the accidental release of materials potentially damaging to the aquatic and wetland environments in Mobile Bay and Mississippi Sound could occur from several activities:

- o Well servicing.
- o Pipeline rupture.
- o Well workover.

The effects of loss of well control has been discussed for the drilling phase.

Well Servicing

5.310 Various solvents, chemicals and lubricants could be used in small quantities for normal day-to-day service of the well and gathering system. Spills of these materials could occur in small volumes. Environmental effects, if any, would be very localized.

Pipeline Rupture

5.311 If the gathering system pipelines are ruptured the contents of the lines between check valves could be released to the Bay or Sound waters or to adjacent wetlands. Rupture of the corrosion inhibitor lines would spill only inhibitor. Rupture of the produced gas line would release gas along with natural gas liquids, water condensed from the gas and corrosion inhibitor. The effect of a gas release has already been described in the section on spills of toxic or hazardous materials for the drilling phase.

5.312 Spills in Mobile Bay or Mississippi Sound. The effects of the accidental release of corrosion inhibitor would be similar to an oil spill, since the carrier fluid often used is similar to a viscous crude oil in consistency. The fluid (Tretolite KP-111) to be used by Mobil Oil for production of sour gas from the Lower Mobile Bay Field is an example. This corrosion inhibitor is 90 percent cyclic amidine and 10 percent commercial solvent (similar to kerosene). This inhibitor is dissolved in a carrier fluid at a maximum concentration of 4 percent inhibitor by weight (U.S. Army Corps of Engineers, 1982a). The volume spilled would vary depending on the length of pipe drained since check valves are used at intervals along the line. No check valves would be used between the origin of a pipeline at a production platform and the landfall. Check valves would probably be included at intervals along the on-land portion of the line leading to the processing plant. If the entire 28 miles of line in the Mobil system were drained (14 miles to and from the wells), about 300,000 gallons would drain into Mobile Bay. Because of the segmentation of the lines with check valves, it is likely that considerably less than 300,000 gallons would be spilled. The effect of a corrosion inhibitor spill in Mobile Bay or Mississippi Sound would vary depending on where it occurred, the time of year and the particular tide, wind and weather conditions at the time of the spill. As discussed in the drilling section for an oil spill, both direct toxic effects and long-term sublethal effects are of concern.

5.313 Spill in Salt Marshes. A leak or spill of corrosion inhibitor in a salt marsh area would probably result in the death of vegetation in the vicinity of the spill from the concentrated pool

of material. The effect of inhibitor spreading to other parts of the marsh would be similar to that described previously for an oil spill in the drilling phase.

5.314 Spill in Forested Wetlands. A leak of corrosion inhibitor would probably kill the vegetation in the vicinity of the leak. The effect of a pipeline rupture would be similar to that of an oil spill described for the Mobile River Delta.

Well Workover

5.315 The activities undertaken during well workover would be similar to many that take place during drilling and well completion. The kinds of accidental spills and effects that could occur have been described in those sections.

Socioeconomic Effects of Spills

5.316 The effects from a spill during the production phase of resource development would be the same as those described under drilling in this Chapter.

Accidental Release to the Atmosphere of Natural Gas Containing Hydrogen Sulfide

5.317 Effects from an *accidental release*, during production, of gas containing hydrogen sulfide would be the same as those described for the Delta.

ABANDONMENT

5.318 When the economically productive life of the field is over, the field is abandoned. The wells are plugged with cement and the surface casing cut off below the sediment surface in accordance with the requirements of the Alabama and Mississippi Oil and Gas Boards regulations. Wellsite equipment and platforms would be removed. Pipelines would be emptied of fluids and abandoned in place. Canals and slips in salt marsh wetlands would be refilled, as would any dredged channels within open water.

Well Site

5.319 Abandonment of the well site involves plugging the well with cement and removal of well site equipment and structures.

Water Quality

5.320 In abandoning a well site in Mobile Bay or Mississippi Sound, all existing above ground structures would be removed. Increases in turbidity would result from these activites, similar to the construction activities discussed above. Pipelines would be left in place.

5.321 Abandoning a well in a salt marsh would be the same as similar activities in the Mobile River Delta. Site restoration would result in similar impacts on water quality as in the Mobile River Delta. The primary differences between Mobile River Delta wetlands and marshes adjoining Mobile Bay or Mississippi Sound are due basically to the greater salinity concentrations adjoining Bay/Sound. Larger values of ionic strength in the water column of more saline waters encourage mobility of ions and coagulation of particles.

5.321a Site restoration would eventually result in regaining wetlands lost during installation activities. Water quality benefits of the presence of wetlands (see paragraph 4.59) would eventually be regained as well.

Hydrology

5.322 Abandonment of a well site would result in short-term, localized changes in water circulation due to moored barges and boats. Within a canal, moored barges could also locally affect water levels whenever water levels are changing.

5.323 Following hydrocarbon activities, only the shell pads would remain. Within the Bay and Sound, shell pads would only result in small current eddies within a few hundred feet of the pad.

Aquatic Ecosystems

5.324 The turbidity resulting from removal of a mobile drilling rig or fixed platform would be very localized and short-term. In most areas of the Bay and Sound only the immediate vicinity would be affected.

5.325 If an inland barge rig drill site was in or very near a seagrass bed, abandonment could affect surrounding area by the spreading out of the shell foundation pad and by redeposition of sediments. Area covered by shell material may not be recolonized immediately because the coarse substrate is unsuitable (Stevenson and Confer, 1978).

5.326 The effects of temporary and localized increases in turbidity on seagrass beds adjacent to the abandonment operations would be less certain. Phillips (1976) reported that seagrass beds adjacent to dredging operations have been impaired or decimated by high silt loads. Stevenson and Confer (1978) concluded that while increased turbidity may be detrimental due to the lessening of light penetration and silting of plant leaves, the impact of suspended solids on submerged aquatic vegetation is not wholly negative. The deposition of silt and clay particles can aid in building up suitable bottom substrates in barren areas by adding nutrients to existing substrates (Odum and Wilson, 1962).

5.327 A shell pad located in an oyster area would serve as substrate for setting of oyster larvae. Turbidity from abandonment operations would not have long-term effects as long as shell area was not buried.

Wastewater Disposal

5.328 Other than wastewaters from marine vessels and disposing chemicals that were not utilized during production, wastewater would continue to be transported to upland facilities for treatment and disposal.

Groundwater

5.329 Abandonment of oil and gas production facilities in the estuarine waters of Alabama and Mississippi are subject to the same regulations and impacts previously described for the Delta area. Mississippi regulations and requirements are also similar to those described previously for the Mobile Delta.

Air Emissions

5.330 Air emissions resulting from abandonment are shown in Table 5-3.

Noise

5.331 Abandonment of well sites in the Mobile Bay and Mississippi Sound offshore area would be similar to procedures described for the Delta. Production platforms would be dismantled and pilings/caissons removed. This would produce construction and service boat noise.

5.332 Pipelines would be emptied and abandoned, with surface facilities being removed. Larger vessels would likely be required in the Mobile Bay and Mississippi Sound area as compared to the Mobile River Delta.

Solid and Hazardous Waste

5.333 Solid waste produced during this activity include unsalvageable construction materials, production equipment, and debris. All materials are barged to shore for disposal at an approved site.

Socioeconomic Characteristics

5.334 Procedures and manpower requirements to secure a well hole during abandonment are described in Chapter 4 for the Delta. Following the capping of a hole in the Bay or Sound, the platform, mooring structures and other potential disruptions to navigation would be dismantled. In the case of an inland barge in the Bay, a decision would be made on whether or not the shell pad should be removed. The effects, then, would be the same as those described in Chapter 4.

5.335 Removing equipment from a salt marsh would require backfilling. This is a simple operation in which a local business could participate.

5.336 With abandonment of a well, royalty and severance tax payments would cease.

Navigation

5.337 The waterway traffic due to abandonment of a dry hole or abandonment of a well at the end of its economic life consists primarily of boats used to remove equipment and to support any required restoration efforts. A tug would return to the drill site to return the drill rig (barge, jackup or submersible) to its port of origin or to transport it to its next work site. For a fixed platform, a tug with barges would be used to remove the plataform subassemblies. A crew boat or boats would continue to shuttle workers between the drill site work area and a local staging area. At any sit where a channel, access canal and slip had been dredged, a tug would deliver a barge mounted dredge for restoration efforts. Restoration of the area dredged could require the transport of several barge loads of extra fill material. There would also be several small boat trips by Federal, State, and company officials checking on completed restoration efforts.

Pipelines

5.338 Pipelines would be flushed, drained and abandoned in place. The crew responible for pipeline maintenance would handle the operation. If properly flushed, no hazardous or toxic materials would be released to the environment upon breaching of the abandoned pipe from future deterioration.

Scale for Spill Movement Vectors

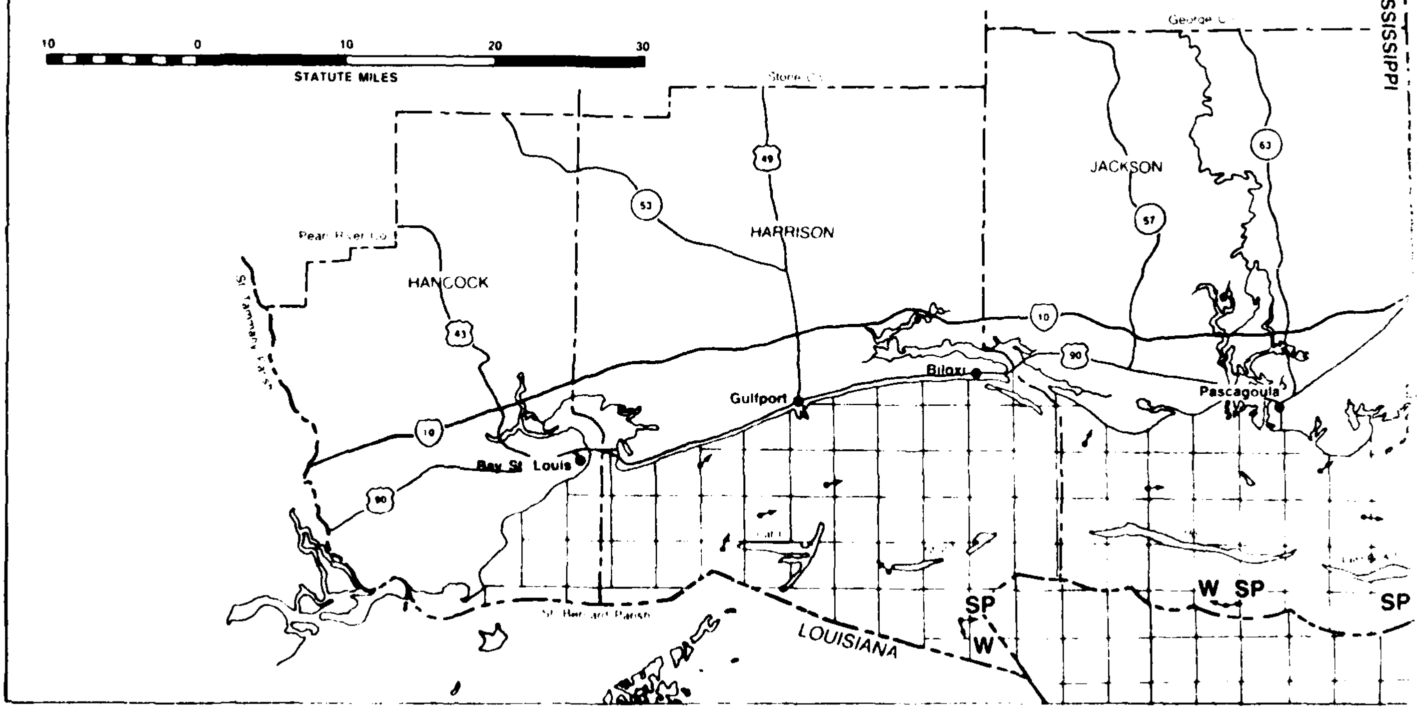
0 2 4
FEET PER SECOND

Code for Gulf Vectors

W - Winter 1980-1981 spill movement
SP - Spring 1981 spill movement
SU - Summer 1981 spill movement

Sources for current vectors:

U.S. Army Corps of Engineers, 1983c, 1983d



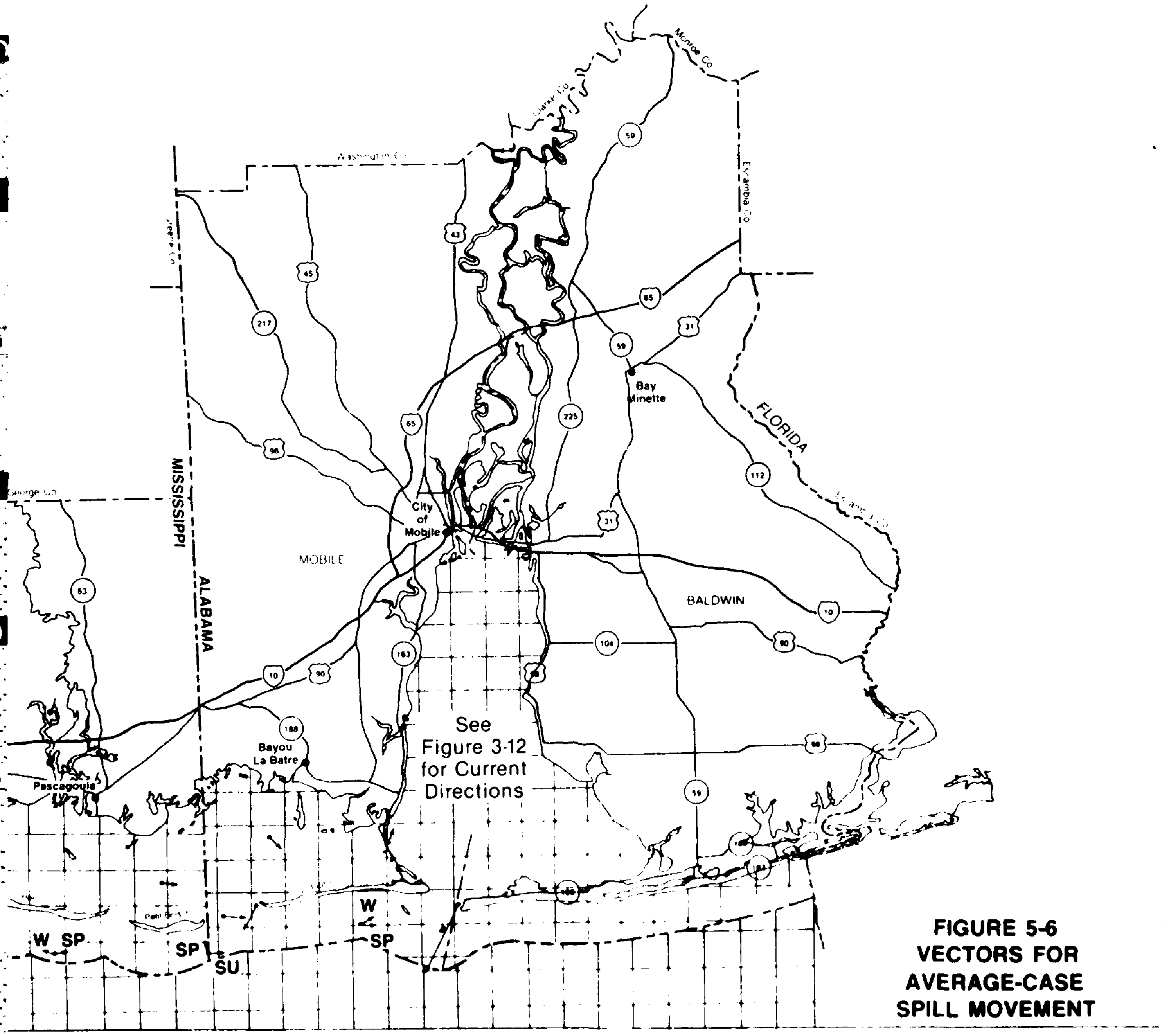


**FIGURE 5-6
VECTORS FOR
AVERAGE-CASE
SPILL MOVEMENT**

Scale for Spill Movement Vectors

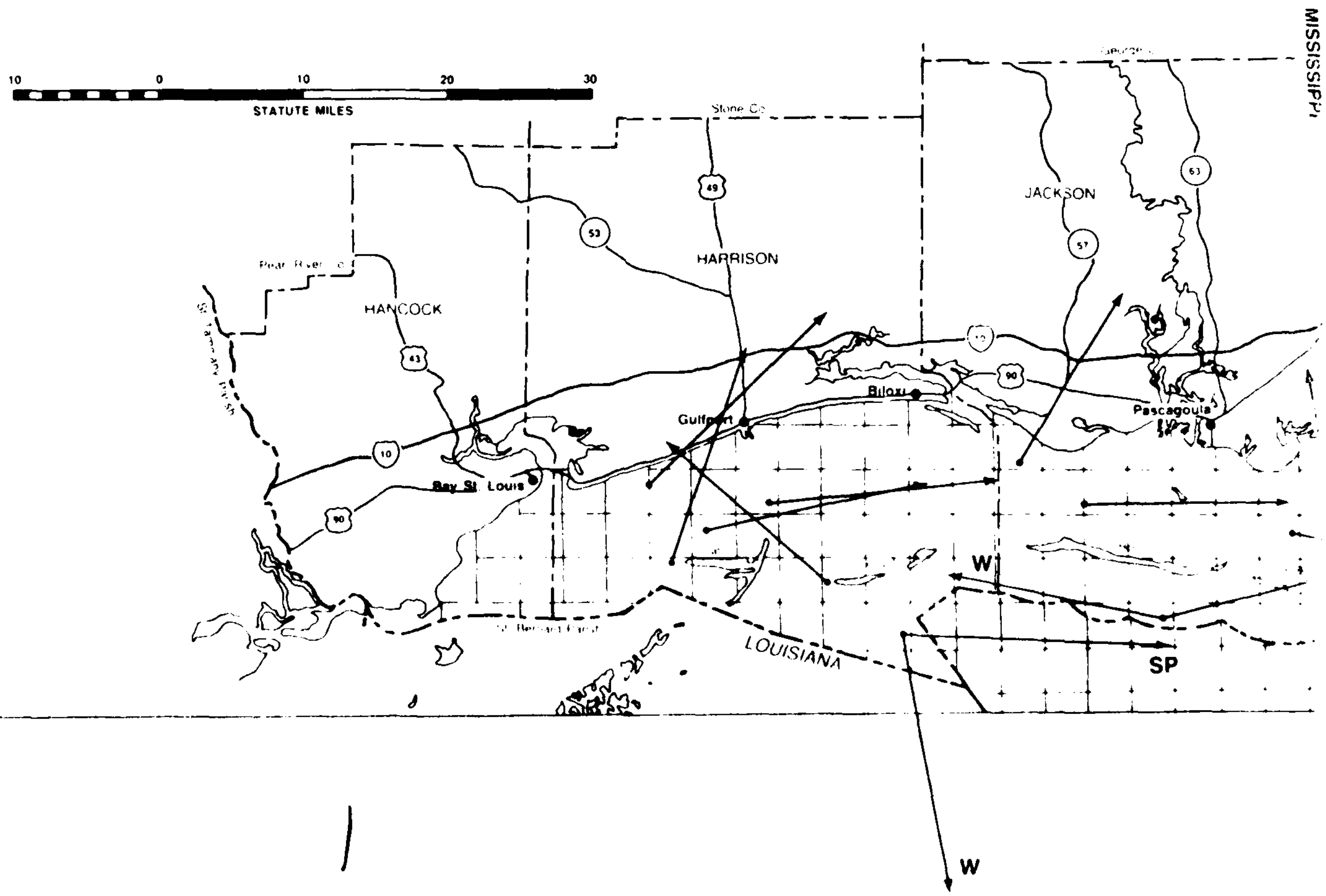
0 2 4
FEET PER SECOND

Code for Gulf Vectors

W - Winter 1980-1981 spill movement
SP - Spring 1981 spill movement
SU - Summer 1981 spill movement

Sources for current vectors:

U.S. Army Corps of Engineers, 1983c, 1983d



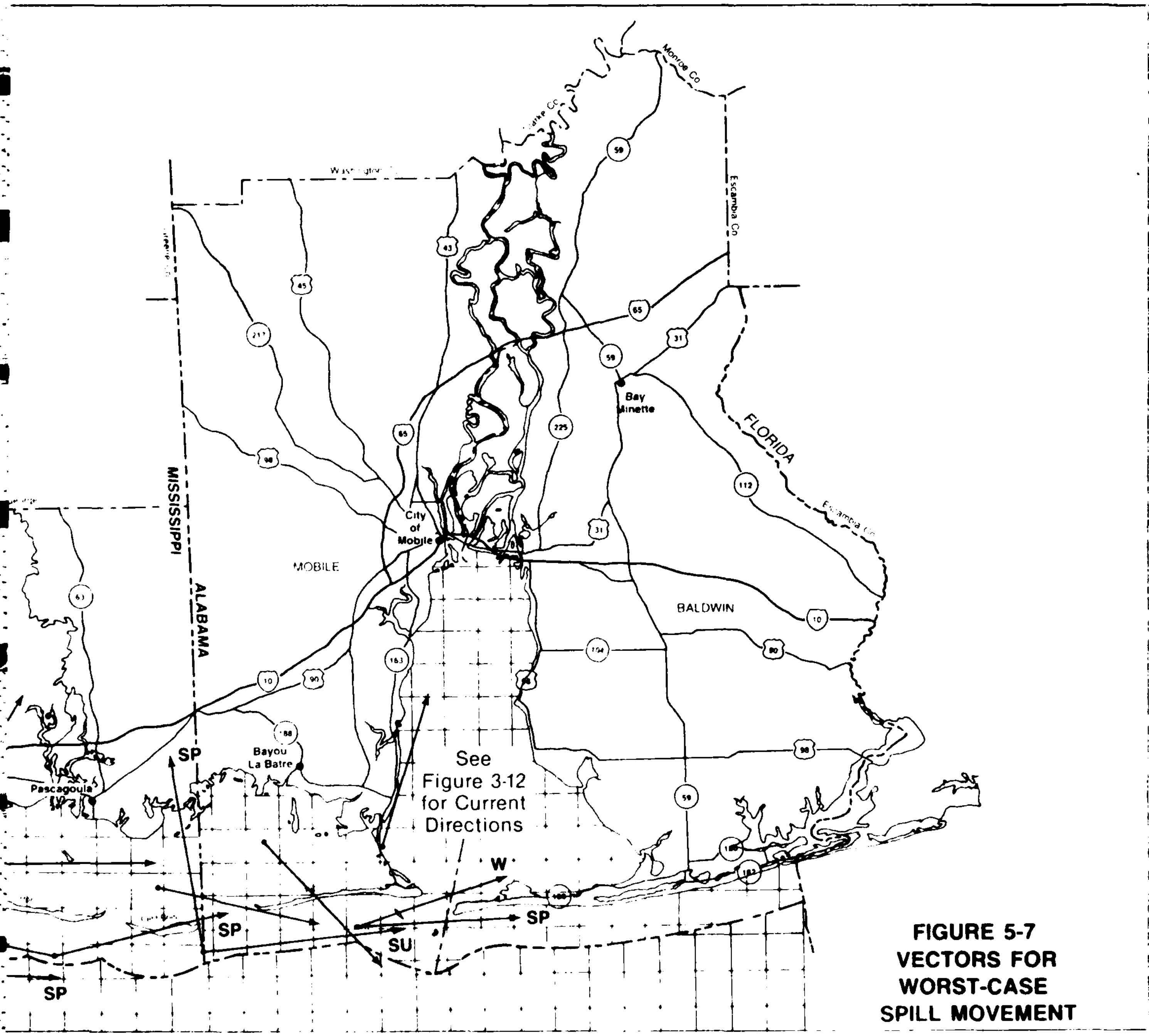


FIGURE 5-7
VECTORS FOR WORST-CASE SPILL MOVEMENT

2

CHAPTER 6

ENVIRONMENTAL CONSEQUENCES OF UNIT ACTIONS IN THE STATE WATERS OF THE GULF OF MEXICO

INTRODUCTION

6.1 Potential environmental loadings and generic environmental effects associated with hydrocarbon exploration and production unit actions in the Alabama and Mississippi state waters of the Gulf of Mexico are discussed in this chapter. A unit action is defined as a group of activities or sequence of events that occur together to complete a particular portion of a phase of hydrocarbon exploration and production. Some examples of unit actions are site preparation for a drilling alternative, well completion, and gathering system construction.

6.2 The analysis is presented according to the four major phases of activities that take place. Reasonable alternatives available for carrying out the necessary activities within each phase have been considered:

- Geophysical Exploration Phase
- Drilling Phase
  - Jackup drilling rig
  - Submersible drilling rig
  - Fixed drilling platform
  - Directional drilling from uplands
- Production Phase
  - Well completion
  - Production platform installation
  - Gathering system construction
  - Normal operations of wells and pipelines
  - Well workover
- Abandonment Phase
  - Well sites
  - Pipelines

Spills of toxic and hazardous materials and the accidental release to the atmosphere of natural gas containing hydrogen sulfide are also considered for the drilling and production phase. Although land subsidence has occurred at various locations around the world due to production from oil and gas fields (Holzer and Bluntzer, 1984), it has not been a factor in the areas under consideration in

this study nor would it be expected to be a factor for production from the deep formations under consideration (Mink, 1984b). Reduction of underground pressures has in some instances resulted in surface subsidence. In this region, no subsidence would be expected because of the depth of occurrence, stratigraphy, and rock strength or competence of the Smackover-Norphlet reservoirs. Rock units from 5,000 feet to as much 21,000-22,000 feet consist of consolidated competent limestone, shales, and sandstones. Fluid or gas withdrawal would not result in subsidence, since the reservoir fabric and the overburden are not supported by liquids or gas (U.S. Army Corps of Engineers, 1980).

6.3 Only those activities that would occur within the state waters of the Gulf are considered in this chapter. Associated activities that would occur within the adjacent coastal estuaries have been discussed in Chapter 5. Associated activities that would take place on upland areas are discussed in Chapter 7. A summary of loadings and generic effects is given in Tabular form in Chapter 2.

Approach to Analyses

6.4 Environmental loadings resulting from exploration and production activities have been determined for each unit action and the generic environmental consequences of each activity are discussed. For example, the amount of benthic habitat disturbed by pipeline construction has been calculated and the generic effects of the disturbance of benthic communities discussed. However, the significance of this effect on the Gulf ecosystem would depend on the total area altered at any time. This analysis is presented in Chapter 8 (Environmental Consequences of Regional Resource Development Scenarios). The unit action analyses of Chapter 6 serve as a basis for the cumulative effects determined in Chapter 8.

Organization of Chapter

6.5 The discussion of potential environmental loadings and generic effects that could occur in the state waters of the Gulf of Mexico has been organized around the four major activity phases of geophysical exploration, drilling, production and abandonment, which constitute the major sections of the chapter. The details on loadings and generic effects associated with activities for each major phase are presented. These analyses are divided into site preparation, routine operations, and accidents.

GEOPHYSICAL EXPLORATION

6.6 In the Alabama and Mississippi state waters of the Gulf of Mexico, with depths generally from 20 to 50 feet, seismic survey operations would be the same as standard offshore operations.

Seismic Survey Boats

6.7 A 150-foot survey boat would tow a 1 1/2 to 2 mile long seismic cable. Most of the cable would be in relatively deep water with only the ends at the survey boat and at the tail buoy coming near the surface. The seismic energy source most commonly used would be the air gun.

Water Quality and Hydrology

6.8 No effects which have not already been discussed in Chapter 5 for seismic survey boats in Mobile Bay or Mississippi Sound. Unavoidable losses of waste fuel and oil from boats would affect water quality. Effects on hydrology would be negligible.

Aquatic Ecosystems

6.9 Survey boat operations are basically the same as other similar sized craft and would not produce any significant impacts on aquatic organisms. Air gun operations (normally used in these waters) do not produce the massive energy pulse that unconfined explosives produce. While unconfined explosives are known to kill fish in the immediate vicinity and produce injuries further away, air gun operations are not known to damage marine life (Gilbert, 1983).

Wastewater Disposal

6.10 Wastewater from well sites would be collected and discharged onshore into a municipal sewer system, assuming the local wastewater agency approves such a discharge to their system. Discharges from marine vessels would be allowed in accordance with U.S. Coast Guard regulations.

Groundwater

6.11 Offshore exploratory activities have little impact on groundwater resources. Unlike upland exploration, potential impacts from land disturbances are minimized since equipment is transported to the site by barge or boat and there is no contact with the ocean floor or subfloor aquifers other than the energy waves from the seismic energy source.

Air Emissions

6.12 Table 6-1 illustrates the scheme used to determine vehicular and equipment emissions in the Gulf of Mexico. This scheme is similar in many respects to the previous analytical

TABLE 6-1

SCHEMATIC OF METHOD FOR ANALYZING POTENTIAL VEHICULAR EMISSIONS IN THE GULF OF MEXICO

Resource Extraction Phase	Activity Level Factor	Activity Duration (Days)
GEOPHYSICAL EXPLORATION	1	180
DRILLING	3	180
PRODUCTION		
Well Completion	2	30
Gathering Systems	2	100
Normal Operations	5	300
Well Workover	1	60
Enhanced Recovery	3	90
Abandonment	1	30

schemes; however, there are some major differences. For geophysical exploration an activity factor of one is used. In this activity a mixture of helicopter and pull boat emissions are used. Only the drilling platform type of rig is assumed during the drilling activity. Production emissions and actual rig emissions are assumed to be similar to those shown above in the Mobile River Delta section.

6.13 One important point which must not be overlooked is vapor emissions from storage. Vapors from hydrocarbon storage was found to be a major source of atmospheric emissions from offshore oil and gas development and production (U.S. Environmental Protection Agency, 1977). It is assumed that no storage is to be used in this area because of the proximity to the coast. It is presumed that the recovered product is to be transported to onshore treatment facilities via pipelines.

6.14 Table 6-2 indicates how these support vehicular activity emission levels for the air portion were determined. It was assumed that two helicopters would fly an average of four hours/day for 200 days per year. This is the definition of activity level one. The resultant pollutant emissions shown in the table.

6.15 The determination of the support vehicular activity emission levels for the sea vehicle are also shown in Table 6-2. An activity level of one was assumed for two boats operating 4 hours per day for 200 days per year.

6.16 Air and sea vehicular activity emission levels for each phase of hydrocarbon resource development are shown in Table 6-3 for the Gulf of Mexico area.

Noise

6.17 Noise produced by geophysical exploration in Gulf waters would be minimal. Levels similar to ambient marine traffic as described for the Bay and Sound would be expected.

Solid and Hazardous Waste

6.18 Geophysical exploration activities in nearshore ocean waters rely on the same types of vessels and techniques as exploration activities in the shallow water areas. The major solid waste impacts from the use of these seismic vessels are accidental spills or leakage of fuel oil and lubricants. Garbage and sanitary waste would also be produced on those vessels with crew quarters and disposed of onshore at an approved site.

TABLE 6-2

TYPICAL VEHICLE EMISSIONS ASSOCIATED WITH HYDROCARBON DEVELOPMENT ACTIVITIES IN THE GULF OF MEXICO

	Emissions (Tons Per Year)				
Vehicle	Carbon Monoxide (CO)	Hydro-Carbons (HC)	Nitrogen Dioxide (NOX)	Sulfur Dioxide (SO2)	Total Suspended Particulates (TSP)
Helicopter[a]	13.74	1.27	1.37	0.422	0.581
Boat[b]	2.98	0.206	0.315	0.014	0.001

[a]Typical calculation in Tons Per Year (Appendix G, Page 2-49):

$$\frac{\frac{0.11\ \text{kgm}}{\text{cycle}} \times \frac{3\ \text{cycles}}{\text{hr}} \times 1000\ \frac{\text{gms}}{\text{kgm}} \times 4\ \frac{\text{hrs}}{\text{day}} \times 2\ \text{helicopters} \times 200\ \frac{\text{days}}{\text{year}}}{454\ \frac{\text{gms}}{\text{lb}} \times 2000\ \frac{\text{lbs}}{\text{ton}}}$$

= 0.581 TPY of TSP

Assumptions are that 2 helicopters operate 4 hours per day, 200 days per year at Activity Level 1. Helicopter emission factor derived from AP-42

[b]Typical calculation for Tons Per Year (Appendix G, Page 250)

$$\frac{0.008\ \frac{\text{kgm}}{\text{hr}} \times 1000\ \frac{\text{gm}}{\text{kgm}} \times 4\ \frac{\text{hrs}}{\text{day}} \times 200\ \frac{\text{days}}{\text{year}} \times 2\ \text{boats}}{454\ \frac{\text{gms}}{\text{lb}} \times 2000\ \frac{\text{lbs}}{\text{ton}}} = 0.014\ \text{TPY of } SO_2$$

Emissions are based on 2 boats/day, 4 hours/day/boat and 200 days/year at Activity Level 1. Boat emissions factor derived from AP-42.

TABLE 6-3

EMISSIONS GENERATED BY RIG AND VEHICLE OPERATIONS DURING HYDROCARBON RESOURCE DEVELOPMENT IN THE GULF OF MEXICO

Resource Extraction Phases	Activity Level Factor	Emission (Tons Per Year) Carbon Monoxide[d] (CO)	Hydro-Carbons (HC)	Nitrogen Dioxide (NOX)	Sulfur Dioxide (SO2)	Total Suspended Particulates (TSP)	Correction Factor
GEOPHYSICAL EXPLORATION[a]		(16.720)[c] 13.780	(1.476)[c] 1.280	(4.520)[c] 1.380	(0.436)[c] 0.423	(0.582)[c] 0.582	-- --
DRILLING[a]	3	37.195	3.456	3.726	1.104	1.571	180/200
PRODUCTION[a]							
Well Completion	2	4.133	0.384	0.414	0.1269	0.1746	30/200
Gathering Systems	2	13.780	1.280	1.380	0.423	0.582	100/200
Normal Operations	5	103.320	5.860	10.350	3.170	4.365	300/200
Well Workover	1	4.133	0.384	0.414	0.1269	0.1746	60/200
Enhanced Recovery	3	18.600	1.728	1.863	0.571	0.786	90/200
Abandonment	1	2.070	1.920	0.207	0.0634	0.0873	30/200
RIG OPERATION[b]	-	162.000	2.800	390.000	26.000	13.400	--

[a]Emissions tabulated are those generated by helicopters and boats.

[b]All phases of rig operations were considered in assessing these emissions. In short, emissions from the rig during activities such as well completion and well workover are included here and not in the columns covering well workover or well completion. See Appendix G, page 2-36.

[c]Revised boat emissions, see Table 6-2. Not carried forward to modeling.

[d]Based on four(4) rigs.

Socioeconomic Characteristics

6.19 Usually, two vessels are used with a combined crew of 15 or 16; 2 to 3 crew members could be local hires. Work can be conducted on a 24-hour basis, so the crew sleeps on board. The survey team comes to shore only between contracts, or to take on supplies and fuel.

Navigation

6.20 A seismic vessel towing a two mile long seismic cable could affect ship traffic if precautions were not taken. Although the seismic cable is designed to operate relatively deep and ships could pass over the cable, under safe operating practices ships are not allowed to pass between the survey ship and the tail buoy (Young, 1983, Personal communication). In addition, operations can be planned to avoid the heavy traffic when fishing fleets move to and from their home ports by having survey operations avoid crossing the main navigation channels during such times. Local knowledge of fishing fleet operations is particularly useful in such cases.

Surveys from Uplands

6.21 Although some level of seismic data could be obtained with the seismic energy source on the uplands and the hydrophones trailed into the water, this is not a practical alternative. Additional discussion of this alternative is presented in Chapter 7.

DRILLING

6.22 After a geological formation that could potentially contain hydrocarbons is identified by geophysical exploration, a well must be drilled to determine if hydrocarbons occur there. If commercially recoverable quantities are found, additional wells are usually drilled to recover the maximum quantity of the rsource in the most efficient and cost-effective manner consistant with the regulations of the Alabama or Mississippi Oil and Gas Board. In general, a surface drilling location directly over the geological target (vertical hole) is preferred whenever possible for the initial well (wildcat well), when subsurface geological conditions are unknown. Subsequent drilling may include directionally drilled wells (slant drilling) to reach subsurface locations lateral to the surface drilling site.

6.23 The types of drilling methods likely be used in Alabama and Mississippi state waters of the Gulf of Mexico are as follows:

- o Jackup or submersible rig
- o Fixed platform
- o Directional drilling from an upland location

Alabama, Mississippi and National Park Service regulations would not allow a drilling rig closer than one mile to the Gulf of Mexico shoreline. With these restrictions, water depths at a drilling site would vary from about 20 to 50 feet except near the eastern end of Dauphin Island. At these depths it is unlikely that an inland drilling barge would be used.

Jackup and Submersible Drilling Rig

6.24 The effects associated with the use of a jackup or submersible rig for drilling in the Gulf of Mexico would be basically the same as those described for their use in Mobile Bay or Mississippi Sound (Chapter 5). No discharges of wastewaters of any type would be allowed from hydrocarbon facilities to Alabama or Mississippi state waters. Discharges would need to be either transported to suitable upland facilities or properly treated and discharged to Federal waters, if allowed. The U.S. Environmental Protection Agency regulates wastewater discharges to offshore Federal waters (beyond that state waters, 3 miles or more offshore of barrier islands).

Fixed Platform

6.25 A fixed platform could be erected at the drilling site and the well drilled from it as an alternative to using a mobile drilling rig. Because of the expense of constructing a platform, its use for drilling the initial exploratory well at a location is not preferred. For this reason, it is unlikely that a fixed platform would be used for exploratory drilling in the state waters of the Gulf. The environmental effects associated with the use of a fixed platform are about the same as for the use of a jackup or submersible rig.

6.26 If the exploratory drilling operation with a mobile rig discovers commercially recoverable quantities of hydrocarbons, it is possible that a fixed drilling and production platform would be erected at that time. Subsequent development wells would be drilled from the platform. Production from the initial wells could begin while development drilling continues. The environmental effects of drilling from a platform would be the same as those described for a platform in Chapter 5 with the possible exception of wastewater

disposal as discussed previously for the jackup and submersible drilling rig. The effects of platform construction are discussed in the Production section below.

Directional Drilling from an Upland Location

6.27 A small portion of the Gulf of Mexico could be reached by directional drilling from an upland site. With current technology, the lateral displacement of the bottom of a well would be limited to about 1 mile at the 20,000 feet or greater depths of the Smackover and Norphlet formations, which would be of principle drilling interest in the Gulf.

6.28 Suitable upland drilling sites would probably be limited to the Fort Morgan Peninsula and Dauphin Island in Alabama and Cat Island in Mississippi. A permit to drill from the islands within the Gulf Island National Seashore would not be issued under current National Park Service regulations (Thackery, 1983. Personal communication).

6.29 Few suitable drilling sites in Baldwin County and the eastern end of Dauphin Island would be available because of the residential and commercial development along the shoreline. Drilling would be possible if leases could be obtained from landowners. However, the potential danger to the public of such a drilling arrangement would be greatly increased if natural gas containing hydrogen sulfide were accidently released to the atmosphere.

6.30 Drilling from the undeveloped western portion of Dauphin Island and from Cat Island would be possible if leases could be negotiated with landowners. Problems of site access and flooding during storms would increase the difficulty of drilling at such a location. The effects of site preparation and operation of upland drilling sites is described in Chapter 7.

Cultural Resources

6.31 As a result of comments of the Alabama State Historic Preservation Officer on previous permit applications for oil and gas exploration, the Mobile District has required that a cultural resources survey be performed to identify potential resources prior to any project activities. This involves a review of available literature on the area and a search of records for previously surveyed and recorded sites. Following the literature and records search a multi-sensor survey (including marine magnetometer and shallow seismic profiler or bottom coring device) of a proposed well location is run to identify any indications of cultural remains. Such surveys are expected to remain standard practice in the environmental review of any project. Should the multi-sensor survey

identify a potential location of cultural remains, then either additional survey work is required to determine the nature of the potential site or the proposed project activities must be moved to avoid the location.

Commercial Fisheries

6.32 The potential impacts to commercial fisheries due to site preparation and drilling operations in the state waters of the Gulf would be essentially the same as described for these activities in Mobile Bay or Mississippi Sound (detailed in Chapter 5). In general, this would include direct loss of fishing area, possible interference with fishing boat operations and space competition between fishing fleet traffic and oil rig traffic. A major difference is that the state waters of the Gulf do not contain oystering areas. However, the other areas of potential impacts would be the same as in waters of the Bay or Sound.

Spills or Loss of Well Control

6.33 If loss of well control occurs or an accident occurs on the drilling rig or support vessels, materials that could potentially have adverse effects on the aquatic environment would be released. These materials include the following:

- Natural gas containing hydrogen sulfide
- Crude oil
- Fuel, lubricants and hydraulic fluids
- Drilling fluids
- Chemicals

The environmental effects of the release or spills of natural gas, crude oil or other materials have been discussed in Chapter 5 and in other environmental impact statements and assessments for the Mobile Bay region (U.S. Army Corps of Engineers, 1975a, 1980, 1982a, 1982b) and the Gulf of Mexico (U.S. Department of the Interior, 1981c, 1983c).

6.33a Probabilities of accidents occurring can vary depending upon engineering, installation and operation-maintenance procedures. Based on current technology, the probability of a well blowout is estimated to be one for 250 wells, and the probability of a pipeline rupture is estimated to be 0.00138 incidents per year per mile of pipeline. Both well blowouts and pipeline ruptures could

spill a wide range of hydrocarbon quantities depending upon the reason for the accident and the quickness with which the spill is controlled.

Natural Gas Containing Hydrogen Sulfide

6.34 If an accident or loss of well control occurs it is possible that natural gas containing hydrogen sulfide could be released to the water column. The effects of such a release have been discussed for Mobile Bay and Mississippi Sound (Chapter). Effects in the Gulf of Mexico would be similar.

Crude Oil

6.35 The discovery of crude oil in the Alabama and Mississippi state waters of the Gulf of Mexico is currently considered much less likely than the discovery of natural gas containing hydrogen sulfide (see Appendix B). Should a spill of crude oil occur in state waters, water quality, biological and socioeconomic consequences could result.

6.36 General Behavior of Spilled Oil in the Open Gulf. The biological consequences of crude oil spills in the Gulf of Mexico is discussed in detail in the Final Regional Environmental Impact Statement for the Gulf of Mexico (U.S. Department of the Interior, 1983c). The following is a summary of that discussion.

6.37 The biological effects ultimately realized from a crude oil spill in the Gulf waters of Alabama and Mississippi would depend on a number of factors. These include the type of oil spilled, the form of the oil in the environment, size of the spill, wind direction and weather conditions at the time of the spill, time of year, and effectiveness of spill response and cleanup measures undertaken.

6.38 The type of oil that might be spilled in the study area is not known, but South Louisiana crude could be typical because of the dominance of this type of oil in production areas to the west of the study area. The properties of this crude oil are as follows:

o API Gravity (20°C)	34.5
o Naptha fraction (boiling from 20° to 150°C) (wt.%)	18.6
o Saturates - high boiling (wt.%)	56.3
o Aromatics - high boiling (wt.%)	16.5
o Insolubles (asphaltenes) (wt.%)	0.2
o Polar material (wt.%)	8.4

6.39 Once spilled, the composition of crude would change rapidly as weathering and aging occurs. Low molecular weight components and aromatics, which are the most toxic, would be lost rapidly from evaporation and reduced in concentration by dilution in the water column. Higher molecular weight components and saturates, which are less toxic, would be lost more slowly.

6.40 Changes in spilled oil are most rapid during the first 10 days. Spreading occurs immediately so that a slick a few millimeters thick or less is formed. Upon reaching a certain maximum area the slick would break up into patches.

6.41 Evaporation of the most volatile components of the slick occurs within the first 24 hours. The rate of evaporation is directly proportional to wind speed and water temperature. For a medium light crude, as much as 45 to 50 percent of the mass of the spill could be lost by evaporation during the first 10 days.

6.42 Dissolution of low molecular weight aromatic portions of the slick, such as benzene and toluene, would occur rapidly. These may represent less than 1 percent of the total mass of the spill but are acutely toxic.

6.43 Dispersion of the oil slick results from the breaking of waves. Small droplets of stable emulsions from 5 micrometers to several millimeters in size would be formed and dispersed into the water column. The extent of the dispersion process determines the lifetime of the slick because the breakdown processes would be slower in this form.

6.44 Because of its nearness to shore, the behavior of a spill in the first few days would be of most importance in state waters. However, a slick that was transported offshore in the initial time period could continue weathering and still be a threat to the Alabama and Mississippi coastline if brought back onshore after 10 to 36 days.

6.45 For 10 to 30 days after a spill, processes of emulsion formation, sedimentation, chemical oxidation, biological breakdown and tar residue formation would become dominant in determining spill fate. After evaporation and dissolution reduce the spill mass, the remaining heavier fractions become highly viscous because of the formation of a water-in-oil emulsion called "mousse." These emulsions are dispersed rather easily. The weathering process is slower in these emulsions because of the reduced exposed surface area.

6.46 Sedimentation of dispersed or emulsified oil can occur once the density is great enough to allow sinking. Sorption and incorporation into suspended solids hastens sedimentation. Feeding by zooplankton and incorporation into fecal pellets also contributes to the sedimentation process.

6.47 Photo- and auto-oxidation processes enhance dispersion and emulsification of the oil slick. Polymers may also be formed.

6.48 Bacterial decomposition of oil is the most important long-term process in removing oil from the environment. Decomposition rate is dependent on the kinds and abundance of the microbial assemblage, the available inorganic nutrients and oxygen, and the ambient temperature. South Louisiana crude has a high degradation rate. One study found a 97 percent loss of oil in only 30 days from Louisiana sediments by bacterial degradation.

6.49 Tar residue is all that remains after 30 days of a surface slick. This residue can remain on the bottom as tar mats or be broken up by wave action into small tar balls. Further degradation is slow because of the small surface-to-volume ratio. Louisiana crude does not seem to form tar balls because of the low concentration of the asphaltene component. For other crudes, however, as much as 30 percent of the original mass can remain as tar balls.

6.50 Residual oil in the sediments offshore can be degraded to background levels in 1 to 2 years, although data are inadequate. For example, oil spilled at the southern end of the Chandeleur Islands in Louisiana weathered rapidly and after one year the concentration of oil in the sediments was only a few percent of that measured immediately after the spill. If residual tar balls remain in the sediments, storms and wave activity can move them along the bottom and wash them onto the beaches.

6.51 <u>Estimate of Travel Distances for Spilled Oil</u>. Three factors result in slightly different effects of oil spills in the Gulf as compared to Mobile Bay or Mississippi Sound. Gulf of Mexico waters are in general deeper and more saline than waters in Mobile Bay or Mississippi Sound. Secondly, shoreline adjacent to the Gulf of Mexico within the project area consists almost exclusively of beach that moves via wave action and water currents, thereby allowing any spilled hydrocarbons that reach beach areas to disperse more rapidly than at estuarine shorelines. Thirdly, sand bars can inhibit nearshore water movements in the Gulf wherever they form following major storms. Other than these three factors, movements of oil along the water surface would be very similar in the Gulf as in Mobile Bay or Mississippi Sound.

6.52 Distances which a spill could travel within State waters of the Gulf of Mexico can be estimated in the same manner as done for Mobile Bay and Mississippi Sound. Surface current vectors are available from four stations during three times periods (U.S. Army Corps of Engineers, 1983d). Spill travel distances near sensitive locations are presented in Tables 6-4 and 6-5 for average-case and worst-case conditions. Figures 5-6 and 5-7 show surface current vectors for four current meter stations.

6.53 Water movements near Mobile Bay are affected primarily by tidal velocities through Main Pass. Travel distances presented for Main Pass are probably excessive, because the spill would move more slowly as it moves away from Main Pass. However, spills could travel 1 to 2 miles for the average-case and over 30 miles for the worst-case. Current directions toward the barrier islands are more common than directions away from the barrier islands based on available data. Under worst-case conditions, spills within both state and Federal waters could affect barrier island beaches and possibly waters within Mobile Bay or Mississippi Sound. Great variability in surface current vectors at both various locations and various times have been observed, however.

6.54 Based on water current data from U.S. Army Corps of Engineers, 1983d, spill speeds for the average case range from 0.2 to 1.6 feet per second in State Gulf waters. For a surface current of 0.2 feet per second and no wind, a spill could travel 0.4 and 1.6 miles for 3 and 12-hour response times, respectively. For a 1.5 feet-per-second current speed and no wind, a spill could travel 3.1 and 12 miles for 3 and 12-hour response times.

6.55 The worst-case conditions of fast currents in combination with 40-mile per hour winds would in all likelihood not last for 13 continuous hours. Hence, the distances presented in Table 6-5 are extreme distances.

6.56 Behavior of Spilled Oil on Beaches. Once spilled oil contacts the beaches, its fate is determined by several factors. These are the amount of abrasion and sediment scouring of waves (kinetic energy environment),the tidal regime, and the oil quantity. The fine-grained sand beaches of the study area inhibit the penetration and burial of oil into the sediment, make clean-up effort easier, and allow beached oil to be removed by wave action.

6.57 Persistence of beached oil depends on the rate of natural degradation and physical dispersal. Oil in the intertidal zone can be removed within several days by tidal action if penetration of sediments is minimal and no additional oil is deposited. However, oil deposited above the normal intertidal zone could be

TABLE 6-4

MOST LIKELY SPILL MOVEMENT CHARACTERISTICS IN ALABAMA AND MISSISSIPPI WATERS OF THE GULF OF MEXICO FOR THE AVERAGE CASE

Sensitive Area	Predominant or Average Direction of Water Movement within Gulf[1,2] (same for the average and worst cases)	Average Surface Current Speed[2,3] Feet Per Second	Wind Speed[3] Miles Per Hour	Linear Spill Travel Distance in 13 Hours,[4] Miles
Gulf of Mexico State Waters				
Beaches along Fort Morgan Peninsula	From west or east (in conjunction with wind direction)[1]	0.2	0	2.3
Main Pass	From north (ebb tide) and from south (flood tide)[1]	1.5[5]	0	14
Fort Gaines and beaches along Dauphin Island	For eastern half of island movement is from east (ebb tide) and from west (flood tide). Shoreward movement occurs during flood tide with easterly winds. For the western half of the island, circulation is from west or east (in conjunction with wind direction). Average currents for Nov. 1980-Jan. 1981 and March-May 1981 were from the west and southwest respectively.	0.2	0	2.3

TABLE 6-4
(Continued)

Sensitive Location	Predominant or Average Direction of Water Movement within Gulf[1,2] (same for the average and worst cases)	Average Surface Current Speed[2,3] Feet Per Second	Wind Speed[3] Miles Per Hour	Linear Spill Travel Distance in 13 Hours,[4] Miles
Gulf of Mexico State Waters				
Petit Bois Island	Average currents for March-May 1981 and July-Sept. 1981 were from the south and west respectively.	0.1	0	1.4
Horn Island	Average currents for Nov. 1980-Jan. 1981 and March-May 1981 were from the southeast and southwest respectively.	0.2	0	2.3
Cat Island	Average currents for Nov. 1980-Jan. 1981 and March-May 1981 off Ship Island were from the north and west respectively.	0.2	0	2.3

1 Reference: Raney and Youngblood, 1982 based on mathematical simulations of circulation for waters adjacent to Mobile Bay.

2 Reference: USACoE, 1983d for average currents at 1.5 meters below the water surface near the sensitive locations listed in the column on the far left.

TABLE 6-4
(Continued)

[3] Based on Table 3-7 in this Draft EIS.

[4] Based on a spill travelling in a straight line for 13 hours at the average current speed. Effects of inertia and effects of density, viscosity and surface tension differences between the oil and water are included.

[5] Based on data from Loyacano and Smith, 1979 and Jarrell, 1981.

TABLE 6-5

MOST LIKELY SPILL MOVEMENT CHARACTERISTICS IN ALABAMA AND MISSISSIPPI WATERS OF THE GULF OF MEXICO FOR THE WORST CASE

Sensitive Location	Predominant or Average Direction of Water Movement within Gulf[1,2] (same for the average and worst cases)	Average Surface Current Speed[2] Feet Per Second	Maximum Wind Speed Miles Per Hour	Linear Spill Travel Distance in 13 Hours, Miles
Gulf of Mexico State Waters				
Beaches along Fort Morgan Peninsula	From west or east (in conjunction with wind direction)[1]	1.3	40	30.0
Main Pass	From north (ebb tide) and from south (flood tide)[1]	3.6[4]	40	51.0
Fort Gaines and beaches along Dauphin Island	For eastern half of island, movement is from east (ebb tide) and from west (flood tide). Shoreward movement occurs during flood tide with easterly winds. For the western half of the island, circulation is from west or east (in conjunction with wind direction). Average currents for Nov. 1980-Jan. 1981 and March-May 1981 were from the west and southwest respectively.	1.3	40	30.0

TABLE 6-5

(Continued)

Sensitive Location	Predominant or Average Direction of Water Movement within Gulf[1,2] (same for the average and worst cases)	Average Surface Current Speed[2] Feet Per Second	Maximum Wind Speed Miles Per Hour	Linear Spill Travel Distance in 13 Hours, Miles
Gulf of Mexico State Waters				
Petit Bois Island	Average currents for March-May 1981 and July-Sept. 1981 were from the south and west respectively.	2.0	40	36.0
Horn Island	Average currents for Nov. 1980-Jan. 1981 and March-May 1981 were from the southeast and southwest respectively.	1.6	40	33.0
Cat Island	Average currents for Nov. 1980-Jan. 1981 and March-May 1981 off Ship Island were from the north and west respectively.	2.3	40	39.0

1 Reference: Raney and Youngblood, 1982 based on mathematical simulations of circulation for waters adjacent to Mobile Bay.

2 Reference: USACoE, 1983d for average currents at 1.5 meters below the water surface at four stations within or adjacent to State Gulf waters near the sensitive locations listed in the column on the far left.

3 Based on a spill travelling in a straight line for 13 hours at a speed equal to the maximum surface current speed plus 3.5 percent of the maximum wind speed. Effects of inertia of the spilled oil, and effects of density, viscosity and surface tension differences between the oil and water are included.

4 Based on data from Loyacans and Smith, 1979.

very persistent because it would not be subject to wave action. Buried oil could persist for several weeks to several months depending on the depth of burial, the rate of degradation processes and on the amount of working of the sediments by storms and normal changes in beach geomorphology. Contact with the shoreline slows natural weathering processes described above for a spill in the open Gulf.

6.58 Biological Consequences of Spilled Oil. The biological consequences of oil spilled in Alabama and Mississippi Gulf of Mexico waters could vary depending on such factors as the amount spilled, the time of year, wind and weather and the effectiveness of containment and cleanup activities. The biological productivity on the coastal waters makes these issues an important concern.

6.59 In general, the most toxic components of crude oil are the lower molecular weight hydrocarbons that would evaporate or be diluted into the water most rapidly. Water-in-oil emulsions can cause physical effects.

6.60 The soluble toxic lower molecular weight hydrocarbons would be of particular concern during the late winter and spring when the spawning of many fish and shellfish species occurs in the near-shore Gulf waters. The eggs, larvae, and juveniles could be killed, although the extent would be determined by the amount of toxic hydrocarbons dissolved, the length of time potentially toxic concentrations lasted and the total area affected.

6.61 Physical effects due to the viscous nature of oil would be most damaging to organisms that could become coated with oil such as birds, sea turtles and benthic organisms. Birds often die in significant numbers from hypothermia after being coated with oil. Death of sea turtles would be of concern because of their status as endangered species. Benthic organisms would be directly affected by oil brought to the bottom and by ingesting oil in the water column and sediments. Ingested oil can be depurated by many benthic organisms once the source of contamination is no longer present, except for bivalve mollusks, which tend to accumulate hydrocarbons.

6.62 Effects on Commercial and Sport Fisheries. Commercial and sport fishing could be affected by the loss of stock that could result from a spill and from the disruption of activities that would result from the presence of oil on the water. The loss of eggs, juveniles and larvae, if significant, could affect the stock size and temporarily reduce catches. The presence of oil could prevent operations because of the fouling of gear. Residual oil in sediments could continue to foul trawling gear that disturbed bottom sediments for many months if particularly persistent. Oil ingested by

commercial species could also reduce the market value of the catch if taste were affected. The fishery could also be affected if oil entered Mobile Bay or Mississippi Sound (see Chapter 5).

6.63 Socioeconomic Consequences of an Oil Spill. An oil spill or accidental release of other materials in the Gulf could affect recreational beaches and sport fishing activity in the Mississippi-Alabama region. The importance of tourism and the effects of spills along the Mississippi coast has been described in Chapter 5.

6.64 Coastal Alabama accounts for about one quarter of the statewide tourist industry, estimated to be worth about $2.5 billion in 1981 (Adam, 1981). The Gulf Shores area could be most affected by an uncontained spill, since the local economy is closely tied to the resort activities associated with the natural seaside characteristics. Over 1.4 million people visit Gulf State Park annually, while about 120,000 visitors are estimated at Fort Morgan (South Baldwin Chamber of Commerce, 1982). A major accident during the height of the tourist season could directly damage this major economic sector and indirectly affect other area business. Further, an accidental release of natural gas with high concentrations of H_2S could require an evacuation of vacationing populations.

6.65 Recreational marine fishing is a popular, profitable activity off Alabama's coast. During 1979, 204,000 people made 958,000 fishing trips in Alabama's offshore waters (U.S. Department of Commerce, 1980a). It was estimated in 1975 that fishermen directly spent about $5 million to catch 8 million pounds of fish (Alabama Coastal Area Board, 1980).

6.66 As described in Chapter 5, the major well blowout of IXTOC-1 off Campeche, Mexico, in 1979, resulted in a financial loss to the recreation and tourism sector along the Texas coast. The Santa Barbara oil spill of 1969 resulted in a settlement amounting to $13.7 million (U.S. Department of the Interior, 1983c). These examples illustrate the magnitude of economic consequences that can result from a major accident in a resort area. Factors affecting the nature of the damage would include the time of year, location of the accident, efficiency in containing the pollutants and the time required to clean up the spill.

Fuel Oil

6.67 Fuel oil could be spilled at the drilling site or from an accident during transport of fuel to the drilling site. Refined fuel oils are generally more toxic than crude oils because they contain a much greater proportion of lower molecular weight components.

6.68 The amount of fuel that could be spilled would be limited to the amount contained on a drilling rig (typically 75,000 to 100,000 gallons) or transported in a fuel barge (40,000 gallons). The effects of a fuel oil spill would be similar to those described for a crude oil spill.

Chemicals

6.69 A variety of chemicals such as acids, drilling fluid additives, lubricants and rig paint would be used during operation of a drilling rig. Spills of these would probably be of small volume. Studies by TechCon (1980) indicated that chemical spills may have some localized adverse effects, but these materials generally would tend to disperse quickly through dilution and evaporation.

Drilling Fluids

6.70 The used drilling fluids, along with other liquid wastes from the rig, would be transported by barge to an on-land disposal site. Drilling fluids could be spilled to the Gulf from the mud circulating system on the rig or from the waste barge during transport. As much as 5,000 barrels could be spilled in an accidental discharge for a waste varge. The effects of a spill in the Gulf would be similar to those described for a spill in Mobile Bay or Mississippi Sound (see Chapter 5). Overboard disposal of drilling muds containing components approved by the U.S. Environmental Protection Agency is currently allowed in federal waters beyond the 3 mile limit of Alabama and Mississippi state waters.

6.71 Petrazzuolo, as reported by Menzie (1982), presents the following general distances required to achieve certain levels of drilling fluid dilution in marine waters: 10,000 at 100 meters from the origin of the spill; 100,000 at 500 meters, and 1 million at 1,000 meters. Most monitoring results to date indicate background suspended solids levels are achieved 1,000 to 1,500 meters from the origin of a spill of drilling fluids (Menzie, 1982). All of these distances are based on monitoring at offshore platforms.

6.72 Some discharges of drilling fluids within the Gulf of Mexico have been monitored. Four-hundred barrels of drilling fluids discharge in nearshore Gulf waters that were stratified with waters of different densities resulted in an upper plume that was not distinguishable 1,000 meters away from the discharge. Lower plumes are observable only within a few meters of the discharge. For 389 barrels discharged to Gulf of Mexico at 1,000 barrels per hour, background levels of all measured constituents were reached within

1,500 meters. Near-background levels were reached within 600 to 650 meters of the discharge (U.S. Department of the Interior, 1983a). Hence, effects on water quality due to discharges in the Gulf at reasonable flows have been relatively localized.

6.73 Within northwestern portions of the Gulf of Mexico principal tracers of drilling fluids are barium, chromium and iron (Trocine and Trefry, 1983). A pH of approximately 11 is common, as is a density approximately 30 percent greater than the density of water. Additives associated with drilling fluids/muds are bentonite clay, barite, sodium hydroxide, mica flakes, cellulose fibers, lignosulfonate. At lower drilling depths, fresh water is used in place of seawater. Unregulated discharges could occur eight to ten times during drilling of a well (usually one to three months). Discharges usually originate from mud tanks.

Atmospheric Release of Natural Gas Containing Hydrogen Sulfide

6.74 Effects from an accidental release of natural gas containing hydrogen sulfide would be the same as those described in Chapter 4.

PRODUCTION

6.75 During the production phase of an oil and gas field, the hydrocarbon resource is brought to the surface, collected in a gathering system and brought to shore, treated to remove impurities, and transported or sold to an intermediate market. Certain activities must take place in the marine environment before the resource can flow through the system:

- Well completion activities
  - Stimulation or treatment of the geological formation (may not be needed)
  - Installation of wellbore and wellhead production equipment
- Production platform installation
- Pipeline gathering system construction

Once production begins, routine activities that are necessary during the life of the field include the following:

- Routine servicing and maintenance of the well
- Well workover

The production phase is discussed in more detail in Appendix A.

Well Completion

6.76 Completion of the well involves the treatment of the geological formation (if needed) with acids or liquids under high pressure to increase the flow of hydrocarbons, treatment of the well bore to ready it for production, and the installation of casing, tubing and wellhead flow regulating devices necessary to produce the hydrocarbon. A subsurface safety device is also installed to prevent loss of well control during routine production. The rig used to drill the well may be used for well completion or a smaller servicing rig brought in to replace the drilling rig.

Water Quality

6.77 Impacts on water quality due to well completion activities would be the same as for Mobile Bay and Mississippi Sound.

Hydrology

6.78 Local obstructions due to barges and boats would occur just as in Mobile Bay and Mississippi Sound.

Marine Ecosystem

6.79 There would be no new effects on the marine environment if the original drilling unit is used for well completion. Those effects associated with normal drilling operations would continue. If a different mobile rig is brought in for well completion to replace the original drilling rig, temporary and localized effects associated with rig placement would occur.

Wastewater Disposal

6.80 Wastewaters from platforms would be transported to shore or, if allowed treated, transported and discharged to Federal waters just as during the drilling phase.

Groundwater

6.81 During oil and gas production activities, precautionary measures will prevent a direct interface with freshwater-bearing aquifers. These measures include proper well casing and cementing, proper use of drilling muds, spill prevention, and proper installation and operation of injection wells. These topics are applicable to all areas of coastal Alabama and Mississippi and have been discussed at greater length in the previous section. The

potential impacts from well completion, gathering system construction, normal operations, and workover are the same as those described for these activities in the Delta.

Air Emissions

6.82 Air emissions associated with production are shown in Table 6-3.

Noise

6.83 Well completion in the Gulf of Mexico area would be comparable to the Mobile Bay/Mississippi Sound area and to the Mobile Delta. Attenuation of noise would possibly be greater due to the effects of the open ocean.

Solid and Hazardous Waste

6.84 Well completion activities for nearshore ocean areas will be essentially the same as those described for shallow water and Delta areas. Typical waste products would include formation fluids mixed with treatment chemicals and crude oil.

Socioeconomic Characteristics

6.85 The procedures used to complete a well, and the potential influence from these activities on the socioeconomic environment are described in Chapters 4 and 5.

Navigation

6.86 The waterway traffic that would occur due to well completion activities would primarily be crew boat and supply barge movements. Crew boat movements would generally be 3 per day. An additional 2 or 3 trips may be required on a given day for company personnel involved in the treatment operations. The delivery of formation treatment liquids and well completion materials and the removal of waste material would probably require, at most, one barge round trip a day. The exact frequency would depend on the volume of treatment material to be used.

Platform Construction

6.87 In order to produce hydrocarbons from the wells drilled at a surface location, a platform would be erected at the well site. The platform would serve to protect the well heads and as a structure for well head production equipment necessary to produce the hydrocarbon resource from the wells and enter it into the

gathering system. Drilling of development wells may also take place from the platform.

6.88 Several types of platforms could be erected. These include single well head platforms and larger units such as central gathering platforms and quarters platforms for service and maintenance crews.

6.89 The environmental effects associated with platform construction in the Gulf of Mexico would be similar to those described for Mobile Bay and Mississippi Sound (Chapter 5).

6.90 The labor requirements and potential earnings to construct and erect an offshore platform are described in Chapter 5. Deeper waters of the Gulf could necessitate a different platform design than for the Bay or Sound. Production platforms are custom designed to accommodate a variety of natural factors, equipment specifications and possibly crew quarters. It is likely that existing fabrication yards in the Gulf coast states would satisfy demands potentially made by operations in the study area. It has been estimated that between 50 and 80 individuals would be needed, for all shifts, to install a platform (Clark et al., 1978; U.S. Army Corps of Engineers, 1982a). If a crew as large as 80 (40 in each shift) were used, the platforms could be erected within a month. More complex designs could take longer. Members of the workforce that were local residents would circulate their wages in the local economy. Other workers would have minimal interaction with the adjacent area.

Gathering System Construction in Marine Ecosystems

6.91 A pipeline gathering system must be constructed to transport the hydrocarbons from the well surface locations within a field to the on-land treatment facility. In the state waters of the Gulf of Mexico, it is likely that gathering pipelines within a field would be laid from each surface well site to a central gathering platform, from which a single corridor to the upland treatment facility would be used. A typical gathering system might consist of one or two production lines, one or two spare production lines, corrosion inhibitor circulation lines (if needed for gas containing hydrogen sulfide) and a fuel gas line for platform equipment.

6.92 Burial of the pipeline system is required by U.S. Department of Transportation regulations. Trenching could be accomplished by two methods:

- o Jet sled
- o Hydraulic dredging

6.93 In the jet sled method, the pipeline would be placed on the bottom. The jet sled would be pulled along straddling the pipeline. High pressure jets of water dig a trench as the sled moves forward and the pipe drops into the trench behind the sled. Partial burial of the pipe would occur by settling of the slurry created by the water jets into the trench and by slumping of the trench walls. Several passes of the sled over the line may be required to get the pipe to the required depth.

6.94 A hydraulic dredge could also be used to dig a trench. Material removed from the trench would be discharged as a slurry adjacent to the trench. Refilling of the trench after the pipeline is placed into it would be by natural sediment movement resulting mainly from storm events.

Water Quality

6.95 Open pipeline trenches extending from the Gulf of Mexico to upland locations would provide a short-term route for saltwater movement from high salinity waters of the Gulf (approximately 30 ppt) to the lower salinity waters near the Mobile Bay and Mississippi Sound shores (0-10 ppt). As long as waters intruding from the Gulf of Mexico are well mixed vertically, the effects of pipeline trenches are less significant than if bottom waters are more saline compared to waters near the water surface. In the first case, vertical mixing forces would probably overshadow trench effects. In the second case, any trench parallel to tidal currents would further increase the extent of salinity intrusion only until the trenches are tilled by natural transfers of sediments along the Gulf floor.

Hydrology

6.96 Local changes in flow patterns of bottom waters can temporarily occur as pipeline trenches are exposed. Water would tend to flow within the trenches particularly if the trenches are paralled to tidal flows. Otherwise, effects would only occur due to temporary use of barges and boats.

Marine Ecosystem

6.97 Aquatic ecosystems could be affected by gathering system construction from direct destruction and burial of organisms and from turbidity resulting from resuspension of sediments.

6.98 Benthic Habitat Affected. If the jet sled method is used about 2 1/2 acres of benthic habitat would be directly affected per 1000 feet of pipe installation. If hydraulic dredging is used

and the dredged material is placed adjacent to the pipe trench, about 4 1/2 acres of benthic habitat would be directly affected per 1000 feet of pipeline. An area beyond the trench and dredged material placement area could be affected due to resuspension of sediments.

6.99 Effect of Benthic Habitat Alteration. The benthic organisms within the trench and material disposal area would be destroyed. This area would be lost temporarily as feeding and spawning habitat while construction occurs. If backfilling is required, any organisms that had recolonized the affected area since dredging took place would be destroyed.

6.100 Effects of Turbidity. Resuspension of sediments resulting from the trenching and backfilling operation could affect benthic communities beyond the excavation and material disposal area. The generally high sand content of the offshore sediments would reduce the area affected because most material would be deposited rapidly and reduce the probability of a slurry plume flowing along the bottom for extensive distances away from the excavation operation. The effects of turbidity have been discussed in the production section of Chapter 5.

6.101 Effects on Seagrass Beds. Seagrass beds in the construction zone could be lost during the period of construction. No seagrass beds are currently known to exist in the Alabama and Mississippi state waters of the Gulf except at the western end of the Fort Morgan Peninsula (Stout and Lelong, 1981) and in the shallow inlets between Petit Bois and Horn Island and Horn Island and Ship Island (Mississippi Department of Wildlife Conservation, 1982b). However, seagrasses are known to grow in non-turbid areas of the Gulf in water as deep as 75 feet (Alabama Coastal Area Board, 1980). It is possible, but unlikely, that some seagrass beds exist in the deeper portions of Gulf state waters of the study area.

6.102 Should gathering system construction directly destroy seagrass beds or alter them as a result of redeposition of suspended sediments, the loss would be more important than loss of other offshore habitat types because of the relatively small area of seagrass community in the region and the importance of this community type as spawning, feeding and nursery area to the young of many species.

Wastewater Disposal

6.103 The same wastewater disposal practices would in all likelihood be utilized during installation of pipelines as would be utilized during well completion.

Air Emissions

6.104 Air emissions associated with gathering systems in the Gulf are shown in Table 6-3.

Noise

6.105 Methods for offshore pipe laying discussed for estuarine ecosystems (jetting, mechanical cutting, fluidization, and plowing to the above cited models) are probably even more appropriate for marine ecosystems with deeper water. Jet barges with three to four jetting (pump) engines can be used for offshore pipe laying. Barge jetting diesel engines for Gulf of Mexico work could include three EMD 16645 engines at 2,200 horsepower each; three Alco 12251 engines at 2,800 horsepower each; four Alco 18251 engines at 4,500 horsepower each; and three Caterpillar Tractor D379 at 500 horsepower each. Bare engine noise levels of Caterpillar Tractor diesel engines are listed in Chapter 4 (noise levels of presented models and brands may or may not be comparable).

6.106 Tug boats for jetting barges would also contribute noise (Chapter 4). Other noise generated during pipe laying, stringing, and welding may be similar, in terms of noise, to conventional onshore methods previously described.

Solid and Hazardous Wastes

6.107 Wastes produced by this activity would be minimal and similar to those described for the Bay and Sound.

Socioeconomic Characteristics

6.108 Employment requirements for pipelaying in the Gulf would be similar to those for the operation in Mobile Bay or Mississippi Sound (Chapter 5). About 120 individuals would be needed for several months (U.S. Army Corps of Engineers, 1982a). Since pipelaying companies tend to permanently employ skilled workers (Clark et. al, 1978) only a few opportunities would be available to the local labor pool. See Chapters 4 and 5 for details.

Navigation

6.109 The use of a pipe lay barge followed by a bury barge with a jet sled allows a gathering line to be quickly emplaced. With typical short operations time, it is not expected that normal gathering line construction operations would affect navigation in these waters. For a line leading from a platform to land, the potential impacts when it crosses the shallow waters of the Bay or

Sound would be exactly the same as those described in Chapter 5. Similarly, should a line have to cross one of the major navigation channels in the area, it is expected that it would be bored under the channel and not trenched.

Normal Operations of Wells and Pipeline Gathering Systems

6.110 Once construction of production facilities is completed, flow of the hydrocarbon resource through the system commences. Production may last from just a few years for a small field to decades for a large one. Effects and activities associated with normal operations include the continuation of some habitat disruptions, release of emissions to the air, disposal of wastewaters and other process byproducts, the expenditure of money locally for wages, goods and services, and the payment of royalties to the state.

Water Quality

6.111 Surface water impacts due to normal operations would be the same as for Mobile Bay and Mississippi Sound.

Hydrology

6.112 No unique effects on hydrology would arise that have not been discussed already for gathering system construction and also for normal operations in Mobile Bay and Mississippi Sound.

Marine Ecosystems

6.113 Benthic areas disturbed during pipeline construction would begin to be recolonized once the disturbances ceased. No new disturbances would occur to the benthos during the production period except possibly during brief well workover periods. Some local turbidity could occur at the wellsite from service vessel propwash.

6.114 Recolonization of disturbed sediments in pipeline corridors by benthic organisms would be rapid (6 to 18 months) (see Chapter 5). Dewatering and consolidation of sediments could affect the recolonization rate until a stable condition is achieved. Shifting of sediment into the trench by storms would also affect recolonization until the trench was refilled or a stable sediment configuration was achieved. Biological productivity would be reduced until recovery of the area was complete.

6.115 The underwater structure of production platforms would serve as a substrate for the development of a fouling community. The community that would develop on structures in the Gulf state

waters of Alabama and Mississippi would be the Coastal Type of Gallaway et al. (1981). Based on data from Louisiana and Texas platforms (Gallaway and Lewbel, 1982), the dominant organism would be the barnacles Balanus spp. Anemones, sponges, bryozoans and hydroids also would be present but would be only a small portion of the biomass. Both resident and transient fish species would congregate at the platform. Some species are trophically dependent on the fouling community for food. Other species use the platform as shelter and feed in the surrounding area. Many of the larger predator species common to coastal waters would occur as transient residents for short periods.

Air Emissions

6.116 Air emissions associated with normal operations are shown in Table 6-3.

Noise

6.117 Normal well and gathering system operations have been previously reviewed for Mobile Bay and Mississippi Sound and for the Mobile River Delta; noise emissions would be comparable for the Gulf of Mexico.

Wastewater Disposal

6.118 Formation waters would most probably be reinjected at the well site if permitted by the appropriate state oil and gas board. All other wastewaters from platforms would be transported, treated and disposed as done during the drilling phase.

Solid and Hazardous Waste

6.119 Solid wastes produced during well servicing may include cement, trash, sanitary wastes, and small volumes of treatment chemicals and acids which are reclaimed or disposed of at an approved site onshore. Pipeline maintenance may result in small releases of [illegible] into the marine environment, as a result of [illegible] repair [illegible].

[illegible]

[illegible] production platform [illegible] number could [illegible] and [illegible] ation, [illegible] shore after a tour. [illegible] offshore structure daily. [illegible] likely to live in the immediate

vicinity; some individuals would move to the area and become integral parts of the community. Crew members living on the platform could be more flexible in their place of residence; commuting longer distances for a multi-day tour is routine to many crews in the offshore business (see Chapter 5). Pipeline operations are highly automated requiring few employees. Royalty payments and severance tax payments to the state would be made during production. Potential earnings to employees, severance tax payments and royalties are the same as those described in Chapters 4 and 5.

6.120a As described under marine ecosystems, many species of fish use platforms as shelter and feed in the surrounding area. The establishment of platforms offshore would yield additional recreational fishing areas to those already existing in Gulf waters.

Well Workover

6.121 At intervals throughout the life of a well, it may be necessary to carry out well workover services to maintain an adequate rate of production from the well. Well workover may be accomplished with a workover rig placed on the production platform at the well site or by a jackup or submersible workover rig similar to that used to drill the original well. Workover may require several weeks to complete, and activities at the site could be comparable in magnitude to those that occurred during the drilling phase. During workover, the site would be serviced by boat and barge.

Water Quality

6.122 Impacts on water quality due to well workover would be the same as for Mobile Bay and Mississippi Sound.

Hydrology

6.123 No unique effects on hydrology are anticipated due to well workover in State waters of the Gulf which have not been discussed for Mobile Bay or Mississippi Sound.

Marine Ecosystems

6.124 If well workover is accomplished from the production platform, no new disturbance would occur in the marine environment. If a jackup or submersible workover rig is used, the effects would be similar to those described for the drilling phase.

Wastewater Disposal

6.125 No unique wastewater disposal activities are expected which have not already been discussed for other phases of hydrocarbon development in State waters of the Gulf.

Air Emissions

6.126 Air emissions associated with well workover are shown in Table 6-3.

Noise

6.127 Well workover activities were also previously described in the sections for Mobile Bay and Mississippi Sound and for fixed platform rigs in the Mobile River Delta.

Solid and Hazardous Waste

6.128 The techniques required for well workover are essentially the same as those described for shallow water and wetland areas. Offshore wells will require the use of barges for disposal of cements, sanitary wastes, chemicals, drill muds, cuttings, and trash.

Socioeconomic Characteristics

6.129 As described in Chapter 4, well workover involves a crew about the size of a normal drilling team. An offshore rig in the area would have between 20 and 36 people on board at once. Under ideal conditions workover lasts a few weeks. Socioeconomic effects are minimal since crews live on the rig, and interact with the local economy on only a limited basis (see Chapters 4 and 5).

Navigation

6.130 Waterway traffic due to well workover operations would include a mobile workover rig, crew boat, and supply barges. During the workover period, the workover rig would make one round trip to the production location from its port of origin and the tug bringing the rig would return to its home port on delivery and a second tug would be used to remove the workover rig. Crew boats could make from 1 to 3 trips a day between the work area and a local staging area for delivering and returning special service personnel. The main workover crew would stay at the rig as on a drilling job with crew changes on a weekly basis. The delivery of supplies and the removal of waste materials could require approximately one barge trip per day at maximum activity levels.

Cultural Resources

6.131 The potential impacts to the cultural resources of the area due to production operations are similar to those impacts associated with drilling operations. Any production activity that produces surface disturbances has the potential for impacting historical or archaeological sites. In production operations, these activities include the installation of a gathering line system and well drilling in previously undisturbed areas for enhanced recovery operations of oil. However, as previously discussed the Mobile District has required cultural resource surveys before such work proceeds and such surveys are expected to remain standard practice in the area. For a recent gathering line system, the planned route of one of the proposed gathering lines was adjusted so that the route would not go through an area that the multi-sensor survey indicated might contain cultural resources (U.S. Army Corps of Engineers, 1982a).

Commercial Fisheries

6.132 The potential for impacts to area commercial fisheries due to production activities would be essentially a continuation of the potential impacts due to drilling operations: direct loss of fishing area, interference with fishing operations, and space competition between fishing fleet vessels and oil rig vessels. The one new activity, gathering line construction, could produce impacts due to placement of the line or to the operations of the lay barge or the bury barge. However, the operations of these barges should not interfere with fishing vessel operations to any significant extent because of the relatively short operations time of gathering line installation.

Spills of Toxic and Hazardous Material

6.133 During the hydrocarbon production phase, materials potentially damaging to the marine environment could be spilled from several sources. These include the following:

- Well servicing
- Pipeline rupture
- Well workover

The effects of the loss of well control have been discussed for the drilling phase.

Well Servicing

6.134 Various solvents, chemicals and lubricants could be used in small quantities for normal day-to-day service of the well and

gathering system. Spills of these materials could occur in small volumes. Environmental effects, if any, would be very localized.

Pipeline Rupture

6.135 If the gathering system pipelines are ruptured, the contents of the segments of the lines between check valves could be released to the Gulf of Mexico. For a gas gathering system, rupture of the corrosion inhibitor transport line would spill only inhibitor. Rupture of the produced gas line would release gas along with corrosion inhibitor and water condensed from the gas. Rupture of a crude oil gathering line would release crude oil.

6.136 Release of Natural Gas Containing Hydrogen Sulfide. Rupture of a produced gas line would result in the release of gas under high pressure. Most of the gas would pass through the water column and enter the atmosphere. The amount of the dissolved fraction would depend on the gas constituent, its partial pressure, it duration of contact with the water temperature and salinity.

6.137 The fate of natural gas constituents in the Gulf would be similar to that described for Mobile Bay and Mississippi Sound (see Drilling Phase, Chapter 5). In summary, little methane would dissolve because of its low solubility, carbon dioxide solubility would be controlled by the natural buffering system of seawater, and hydrogen sulfide that dissolved would be rapidly diluted and oxidized to sulfates.

6.138 Corrosion Inhibitor. Release of corrosion inhibitor would be similar to an oil spill, since the carrier fluid used is residual heavy fractions from the refining process and would be similar to a very heavy crude oil. A discussion of corrosion inhibitor is in Chapter 5 for the production phase. The effect of an oil spill in the Gulf has been discussed in the section on the drilling phase in the Gulf. Because of the heavy oil nature of the carrier fluid, it is likely that most of the spilled volume would remain as persistent tar residue.

6.139 Crude Oil. The effect of a crude oil spill in the Gulf has been described in the section on the drilling phase. An uncontained oil spill could have significant adverse economic effects on coastal Alabama and Mississippi. Details are provided in Chapter 5.

Well Workover

6.140 The activities undertaken during well workover would be similar to those that take place during drilling and well

completion. The kinds of spills and effects that could occur have been described in the section on spills of toxic or hazardous materials for the drilling phase.

Socioeconomic Effects of Spills of Hazardous or Toxic Material

6.141 An accidental spill during the production phase could cause significant economic damage to recreation and tourism in the area. See the discussion under drilling in this chapter for details.

Accidental Release to the Atmosphere of Natural Gas Containing Hydrogen Sulfide

6.142 Effects from an accidental release of gas containing hydrogen sulfide would be the same as those described in Chapter 4.

ABANDONMENT

6.143 When the economically recoverable oil or gas has been produced from a field, the field is abandoned. The wells are plugged with cement and the surface casing cut off below the sediment surface in accordance with the regulations of the Alabama or Mississippi Oil and Gas Boards.

Well Site

6.144 Abandonment of the well site involves plugging the well with cement and removal of well site equipment.

Water Quality

6.145 Effects of abandonment of well sites in the Gulf of Mexico on water quality would be the same as in Mobile Bay/Mississippi Sound.

Hydrology

6.146 Effects of well site abandonment on hydrology would be of the same type as described in Chapter 5 for Mobile Bay and Mississippi Sound.

Marine Ecosystems

6.147 The turbidity resulting from removal of a mobile drilling rig (if abandoning a dry hole) or a fixed production platform would be very localized and short-term. The benthic area affected would be very small. Productivity of adjacent seagrasses

could be affected briefly. If sedimentation is deep enough, however, additional seagrass areas could be destroyed.

Groundwater

6.148 Abandonment of offshore oil and gas production facilities would produce impacts similar to those previously discussed for the other areas. Abandonment procedures are governed by offshore regulations in both Mississippi and Alabama waters and proper adherence to procedures would limit effects to groundwater supplies.

Wastewater Disposal

6.149 Well site abandonment would not result in any wastewater management activities not already discussed for drilling and production.

Air Emissions

6.150 Air emissions associated with abandonment are shown in Table 6-3.

Noise

6.151 Abandonment procedures are presented for the Mobile Bay Mississippi Sound area and the Mobile River Delta. The same activities and noise sources would apply for the Gulf of Mexico. However, the larger vessels used in the Gulf would typically produce more noise than inland or nearshore vessels. Offshore distances would also imply longer periods of vessel noise.

Solid and Hazardous Wastes

6.152 The sequence of events required for deep water abandonment activities is similar to those required for the Delta and other state waters. Solid wastes produced would consist largely of unsalvageable construction materials, drilling equipment and garbage.

Socioeconomic Characteristics

6.153 Plugging and abandonment procedures in the Gulf would be the same as those described for the bay and sound. First, the production equipment on the platform would be dismantled; then the platform and mooring structures would be removed. It is likely that the crews required for these activities would be about the same size

as in initial platform installation which generally involves two shifts of about forty individuals each. Only a few opportunities would exist for local hires to secure this temporary employment. A locally based dredge/pile driving firm could be employed in this activity. No more than about ten individuals would be needed. A potentially significant economic consequence that would result from this phase would be the cessation of severance taxes and royalties collected by the state (see Chapters 4 and 5).

Pipelines

6.154 Gathering system pipelines would be flushed and drained of fluids and abandoned in place. Pipeline abandonment in the Gulf would follow the procedures outlined in Chapter 4. Minimal if any new employment would be generated from this activity regardless of the location.

CHAPTER 7

ENVIRONMENTAL CONSEQUENCES OF HYDROCARBON EXPLORATION AND PRODUCTION ACTIVITIES OCCURRING ON UPLANDS

INTRODUCTION

7.1 Potential environmental loadings and generic environmental effects of unit actions that would occur on upland areas as part of hydrocarbon exploration and production activities in the Mobile Delta, Mobile Bay, Mississippi Sound and state waters of the Gulf of Mexico are discussed in this chapter. A unit action is defined as a group of activities or sequence of events that occur together to complete a particular portion of a phase of hydrocarbon exploration and production. Some examples of unit actions are site preparation for a drilling alternative, well completion, gathering system construction, and gas treatment facility operation.

7.2 The analysis is presented according to the four major phases of activities that take place. Reasonable alternatives available for carrying out the necessary activities within each phase have been considered:

- Geophysical exploration
- Drilling
- Production

  Well completion
  Gathering system construction
  Treatment facility construction
  Normal operations of gathering system
  Normal operations of treatment facilities
  Well workover
  Enhanced recovery
  Transport of resource to intermediate market
  Service Bases

- Abandonment

  Upland well site
  Pipelines
  Treatment facilities
  Service Bases

The effects of release of gas containing hydrogen sulfide by a pipeline rupture or an accident at a gas treatment plant are discussed in the section on production.

7.3 Only those activities that would occur at an upland location are considered in this chapter. The effects of associated activities within the adjacent wetland or aquatic ecosystems have been described in Chapters 4, 5 and 6.

Approach to Analysis

7.4 Environmental loadings resulting from exploration and production activities on uplands have been determined for each unit action and the generic environmental consequences of each activity described. For example, the amount of land required for the construction and operation of a gas treatment plant has been calculated. However, the significance of this disturbance to the regional environmental would depend on the total upland area altered at any time by all activities. This analysis is presented in Chapter 8 (Environmental Consequences of Regional Resource Development Scenarios). The unit action analyses serve as a basis for the cumulative effects determined in Chapter 8.

Organization of Chapter

7.5 The discussion of potential environmental loadings and generic effects has been organized around the four major activity phases of geophysical exploration, drilling, production and abandonment. Loadings effects are presented by sections giving the details for each phase. For each major phase, effects are discussed for the various necessary activities and reasonable alternatives available.

GEOPHYSICAL EXPLORATION

7.6 Although it is possible to obtain some level of data for some portions of the study area of the Delta, the coastal estuaries and the Gulf of Mexico by having the seismic energy source on an adjacent upland and the geophones extending into the study area, this is not a practical alternative for obtaining high quality seismic data covering a normal area of interest. The energy source normally used on the uplands would be either explosives placed in shot holes or a weight drop or controlled vibration system. With an upland shot it is possible to get some type of data from 1 1/2 to 2 miles into the study area along a line of geophones. However, since it is standard practice to obtain seismic data by continuously advancing the energy source and the geophone groups, an upland-only shot would not produce the quality of data required for a survey.

Additionally, an area survey often has survey lines in a grid pattern and this would not be possible with upland-only surveying. Another problem is access to the shoreline. Much of the shoreline of Mobile Bay, Mississippi Sound and the Gulf waters would not be accessible because of development or use restrictions (e.g., seismic surveying would not be allowed on the islands in the Gulf Islands National Seashore). Because of these restrictions upland-only seismic surveys would not be a practical alternative to seismic surveys within the Delta, Bay, Sound or Gulf waters.

DRILLING FROM AN UPLAND SITE

7.7 Directional drilling from an upland site could be used to reach a small portion of the area within the Delta, Mobile Bay, Mississippi Sound and the Gulf of Mexico. With current technology the maximum lateral distance of the location of the bottom of the well from the surface drilling location is about one mile at the 17,000 to 21,000 foot depths of principal interest in the region.

Site Preparation

7.8 Preparation of an upland drilling site requires the construction of access roads, leveling of the drilling site and assembly of the drilling rig at the site.

Water Quality and Hydrology

7.9 Runoff from upland drilling locations could reach the lower-lying delta, because the no-discharge rule does not apply to upland drilling sites. Runoff could include oils, fuels and other chemicals in addition to water and sediment. Once the runoff reaches the delta, it would move very slowly into the delta. Settleable materials would remain in the delta near the upland site. Soluable materials would slowly drift toward the interior of the delta.

Upland Ecosystems

7.10 Site preparation activities for an upland drilling site with a 1000-foot access road would require the clearing of about 1 to 1 1/2 acres. For an access road with a width of 15 to 20 feet, less than 1/2 acre would be cleared and graded per 1000 feet of road. The road surface would receive a layer of shell to allow drainage and provide all weather access to the drilling site. The length of access road depends entirely on the location of the drilling site in relation to existing roads and there is no standard length.

7.11 The size of the area used for drilling would vary but a 200 foot square area (less than 1 acre) should accommodate all of the drilling activities. The site would be cleared of vegetation, graded, and receive a shell cover (particularly the drilling site, parking areas and vehicle maneuvering areas).

7.12 The type of vegetation that would be cleared would be highly site specific and would depend on the site's location, topography and previous land uses. For example, an upland area could already be cleared if it had been recently farmed or it could be in some stage of old field successional growth if the area was an abandoned farm. Similarly, the natural vegetation would be highly site specific and variable. Whatever the vegetation, clearing would removal all vegetation and destroy any wildlife habitat for the life of the project.

Groundwater

7.13 Impacts to the groundwater resources from upland site preparation activities are minimal. Disturbance of a localized recharge zone of a shallow water table is possible.

Wastewater Disposal

7.14 All wastewater would be treated at an approved treatment facility and discharged in accordance with state regulations. If the wastewater is discharged to a body of water not in the Mobile River Basin, a discharge permit from the governing state would be required. Wastewater could also be disposed to the land or injected into a geologic formation.

Air Emissions

7.15 Air emissions associated with activities on the uplands would be the same as those described for the Mobile Delta Bay and Mississippi sound (Chapters 4 and 5).

Noise

7.16 The uplands environment frequently requires extensive land preparation prior to drilling rig assembly and well production. Land clearing and grading may be more extensive than described for inland marshes and wetlands well sites due to uplands forest vegetation and land topography. Noise levels associated with basic earthmoving equipment are listed in Chapter 4. Some blasting of rock outcrops may also be necessary, which would produce momentary loud noise levels.

7.17 An access road may also have to be constructed, which would involve construction equipment and noise levels similar to site preparation equipment. Trailers established on location could be hauled in by truck. Noise emission sources would include industrial trucks and earthmoving equipment described in Chapter 4. Water well drilling noise would be less than oil and gas well drilling due to a smaller rig.

7.18 If a drilling platform were established, construction involving canes and various other construction equipment would result. Components could be hauled in by truck or transport helicopter (70-90 dB at 1,000 feet; New England River Basin Commission, 1976).

Solid and Hazardous Waste

7.19 Wastes consist of felled trees and cleared vegetation, generally inert construction debris, some trash, and incidental fuel and lubricant spills from construction machinery.

Socioeconomic Characteristics

7.20 There is an established land based hydrocarbon extraction industry in Alabama and Mississippi. Preparing a site and drilling an additional upland well would conform to existing practices and be well within the range of normal activities.

7.21 An average crew of 15 workers is needed to clear an access to a site; 30 workers would be a maximum (Bergeron, 1983. Personal communication). If a large non-local firm won the bid about half the crew could be local labor. The amount of time required would vary from 15 days to 30 days depending on the difficulty of the territory. An access road in a wet area would be contructed of boards (Baker, 1979). The equipment requirements for a board road would include one to five bulldozers and operators depending on the size of the area to be cleared. A gravel or shell access road can require a smaller crew and fewer bulldozers (Bergeron, 1983. Personal communication).

7.22 After the access is cleared the same contractor or a different one would prepare the site directly under the rig. The crew would be about the same size as that for an access road. A couple of bulldozers and operators would also be needed. If a difficult area had to be prepared quickly, laborers from the local labor pool might be used. Otherwise, the crew would be affiliated with the contracting firm (Lemcke, 1983. Personal communication).

7.23 Once the site is prepared, the drilling firm or its contractor will bring the rig on site and set up. All three shifts of the drilling crew participate in rigging up, working only during daylight hours. Depending on crew sizes this could range from 24 (8 in a crew) to 30 (10 in a crew) people. At a minimum, four trucks each with a driver and helper would be used to transport the rig components from its previous location to the new site (Lemcke, 1983, Personal communication). The number of trucks, drivers and helpers used would depend on the distance to the new site and on the size of the rig. Frequently, eight or more trucks are used. As many as 60 separate truck loads could be required to bring in components for a rig capable of drilling 20,000 feet (Appendix A).

Routine Operations

7.24 Once the drilling site has been prepared and the drilling rig assembled at the site, routine drilling operations would commence.

Water Quality and Hydrology

7.25 Runoff would be released just as during the site preparation phase. Commonly-utilized methods to control runoff flows and water quality are available.

Upland Ecosystems

7.26 No additional upland area would be disturbed during routine drilling operations beyond that already disturbed for site preparation.

Groundwater

7.27 Several sources of wastes are generated during drilling operations and may require storage at the site for subsequent disposal. These wastes include spent drilling fluids, cuttings and formation fluids. Under offshore conditions and in the wetlands of the Delta region these wastes would be contained in various tanks, and potential for groundwater pollution would only occur as a result of accidents, including spillage or well blowout, and not during routine operations. However, if upland drilling is considered, the possibility exists for storage of drilling fluids and muds in earthen pits. Fluid storage in pits is not usually allowed except for emergency situations since there is a potential for groundwater contamination. Alabama requires that pits and storage tanks be constructed and maintained to prevent pollution of subsurface fresh water. Emergency reserve pits must be lined with an artificial impermeable material so as to prevent the escape of any contents

which may contaminate the shallow aquifer systems. Impervious lining is also required for temporary salt water storage pits. Thus, proper construction of these storage facilities will prevent contamination of the adjacent waters of the surficial aquifer. A potential secondary impact to the groundwater exists as a result of the ultimate disposal of drilling wastes. Dewatered drilling semisolids from drilling operations in all four geographic regions of the project area are disposed of at several locations throughout the upland region of the project area. This would reduce the possibility of contaminants leaching to adjacent surficial aquifer waters.

Wastewater Disposal

7.28 The wastewater management options listed for the site preparation phase are also valid for routine operations. No discharges to the Delta are allowed, however discharges to waters in creeks or rivers that do not drain to the Delta may be permitted by the State.

Air Emissions

7.29 Air emissions associated with routine operations would be the same as those described for Mobile Bay and Mississippi Sound.

Noise

7.30 Drilling noise from conventional land rigs used in the uplands is assumed to be similar to noise produced from rigs in the other geographic study areas although somewhat noisier due to engine fans (see Chapter 4). Noise levels from generic drilling platforms were previously discussed.

Solid and Hazardous Waste

7.31 Oblique upland surveys, including shothole drilling and clearing for vehicle access, will result in much the same impacts whether these techniques are used for upland or Delta area exploration activities. Solid wastes in the form of excess spoil, incidental trash, and vehicle lubricant and fuel leakage would be produced in relatively small volumes.

Socioeconomic Characteristics

7.32 A conventional land operation requires 8 to 10 people for each of three 8-hour shifts; a fourth crew fills in on an as-needed basis. Personnel within a hundred mile radius would be

likely to commute to the site daily. If a crew member lives outside of this radius he may decide to move closer depending on several factors including: the apparent longevity of the more remote rig operation and the likelihood that the area would be under long term exploration, development and production (see Chapter 4).

7.33 Many land rig crew members live in the Gulf Coast states including Alabama and Mississippi. Daily commutes of these people would result in minor traffic increases at and near the rig site, and some retail purchases as workers come and go. Long distance commuters, in general, would have little interaction in the local economies; but wages earned by those living locally would be circulated in the vicinity and taxed at all levels.

Cultural Resources

7.34 The cultural resources of an upland area, whether historical or archaeological, may be affected by drilling activities in a variety of ways. Historical sites may be affected by alteration and destruction of a property, isolation from or alteration of the surrounding environment, or the introduction of visible or audible elements that are out of character with the property. Archaeological sites, and historical sites that would be investigated using archaeological techniques, are more easily disturbed. Basically, any activity that produces surface disturbances has the potential for impacting an archaeological site.

7.35 Dependent on jurisdictional requirements, one or more levels of cultural resources investigations may be required. Initially, a review of available literature on the area and a search of records of previous surveys in the area and site files is undertaken to determine whether properties listed on or potentially eligible for the National Register of Historic Places are known to exist in the vicinity of the project. Dependent on the findings of this initial review, additional field reconnaissances or surveys may be required. The views of the appropriate State Historic Preservation Officer, National Park Service and other knowledgeable individuals are considered in determining the need for these field surveys.

PRODUCTION PHASE ACTIVITIES OCCURRING ON UPLANDS

7.36 Some of the activities and facilities associated with the production phase of resource exploitation in the Delta, Mobile Bay, Mississippi Sound and the Gulf of Mexico would occur on adjacent upland areas. These would include the following:

- Production activities at an upland well site.
- Gathering system construction and operation.
- Treatment facility construction and operation.
- Enhanced recovery facility construction and operation.
- Service base construction and operation.
- Transport of hydrocarbon resource to intermediate market.

Well Completion at an Upland Well Site

7.37 If a well drilled directionally from an upland location to a geological target under the Delta, Mobile Bay, Mississippi Sound or the Gulf of Mexico can produce hydrocarbons at a profitable rate, the well must be completed before the flow of hydrocarbon can begin. Completion of the well involves the treatment of the geological formation (if needed) with acids or liquids under high pressure to increase the flow of hydrocarbon, treatment of the well bore to ready it for production, and the installation of casing, tubing and wellhead flow regulating devices necessary to produce the hydrocarbon. The rig used to drill the well may be used for well completion or a smaller servicing rig brought in to replace it.

Water Quality

7.38 Runoff during both construction and normal operation at an upland site can add pollutants, particularly solids, oil and grease, to the downstream creek or river. Sanitary wastewaters would be treated on-site or transported to a municipal wastewater treatment plant for treatment and disposal. Produced waters could be re-injected at the well site. As long as runoff and wastewaters are properly managed, impacts on water quality should not create problems. Runoff and wastewater discharges to the Delta are not allowed.

Hydrology

7.39 Without runoff controls, some increase in flows reaching downstream creeks or rivers would result due to development at the well site. Such flow increases would vary from storm to storm and depend also on the size of the land area cleared for well site development.

Upland Ecosystems

7.40 No additional upland area would be disturbed during well completion beyond that already disturbed for the drilling phase.

Groundwater

7.41 Production activities in upland areas include basically the same environmental considerations with respect to groundwater as was discussed for the Delta. Some differences in the regulations with regard to casing requirements exist for upland considerations. For example, an upland well in Alabama requires 1,800 feet of surface casing if deeper than 9,000 feet while an offshore well requires from 2,250 to 3,500 feet of surface casing if deeper than 9,000 feet.

Wastewater Disposal

7.42 The various wastewater disposal options are listed briefly in this section under water quality and throughout this document. All wastewater management activities must be approved by the appropriate state environmental agency. Cooperation with the municipality owning the nearby municipal wastewater treatment plant would also be beneficial.

Air Emissions

7.43 Air emissions associated with production would be the same those identified for Mobile Bay and Misssissippi Sound.

Noise

7.44 Well completion in the uplands would be comparable to that in the Mobile River Delta.

Solid and Hazardous Waste

7.45 Well completion activities for upland areas will be essentially the same as those described for the Delta. Typical waste products include formation fluids mixed with treatment chemicals and crude oil. These materials may be temporarily stored in on-site metal tanks or earthen pits and subsequently transported by truck to reclamation, treatment, or disposal facilities.

Socioeconomic Characteristics

7.46 Well completion is one of the busiest phases over the life of the well. The number of workers at the rig can increase

substantially as service contractors perform their jobs (see Chapter 4). At a land rig site, temporary increases in truck and auto traffic can be expected. Yet, since there is an established land-based service industry in Alabama and Mississippi, such effects would not deviate appreciably from ongoing practices in the region.

7.47 A potentially significant result of well completion is the indication that resources can be produced and thus be taxed by the state. Revenues collected are based on the volume and value of the resource extracted. Alabama has a 10 percent severance tax for onshore resources (8 percent for offshore resources) while Mississippi collects 6 percent (See Chapters 4 and 5).

Gathering System Construction

7.48 A pipeline gathering system must be constructed to transport the produced hydrocarbon from the wells to a central treatment facility. A portion of the gathering system from wells in the Delta, the coastal estuaries, or the Gulf of Mexico would cross uplands to reach the treatment facility. A gathering system from upland wells would probably be completely within upland area.

Water Quality and Hydrology

7.49 No unique impacts on either water quality or hydrology are anticipated due to gathering system construction which have not already been discussed elsewhere. In addition to impacts mentioned for an upland well site, pipeline trenches in tidal areas could result in more salinity intrusion while the trenches are open to Mobile Bay or Mississippi Sound, depending upon trench elevations.

Upland Ecosystems

7.50 In a manner similar to site preparation for drilling, the corridor for the gathering lines would be cleared of all vegetation prior to trenching. For a 50 to 75 foot right-of-way, this would involve clearing from about 1 to 1 3/4 acres per 1000 feet of pipeline systems and the resulting loss of any wildlife habitat.

Wastewater Disposal

7.51 Impacts due to wastewater for gathering systems are the same as those discussed for well completion.

Groundwater

7.52 Impacts to the groundwater resources from gathering systems construction are minimal and similar to those described for drilling site preparation in both the Delta and Upland regions.

Air Emissions

7.53 Air emissions resulting from gathering system construction would be the same as those described for Mobile Bay and Mississippi Sound.

Noise

7.54 Conventional dry-land pipeline laying procedures are employed in upland areas. These techniques (clearing, grading, trenching, blasting, stringing, welding, pipe coating, lowering-in, and backfill and cleanup) produce noise levels such as those described in Chapter 4.

7.55 In their final EIS of natural gas production in the Lower Mobile Bay Field, the Corps of Engineers, Mobile District (1982c) also discuss onshore pipeline construction. Operations of right-of-way clearing, ditching, stringing, welding, lowering-in, backfilling, and grading involving bulldozers, trucks, backhoes, welding machines, side boom cats, and graders were estimated to produce and L_{eq} of 86 dB at 100 feet.

Solid and Hazardous Wastes

7.56 Waste produced by this activity are minimal and limited generally to construction debris.

Socioeconomic Characteristics

7.57 An uplands pipeline is usually constructed by several crew units working simultaneously on different segments (New England River Basin Commission, 1976). Right-of-way clearing and the other activities from trenching through backfilling are essentially the same as those described for a forested wetland in Chapter 4. In summary, the local labor pools can benefit significantly although temporarily from an uplands system, where 35 (New England River Basin Commission, 1976) to 60 percent (U.S. Army Corps of Engineers, 1982a) of the workers could come from the local labor force. It has been estimated that the upland portion of the proposed five line system from Mobile Bay to the southern Mobile County treatment facility would employ 100 individuals at peak construction, 60 of whom could be local hires. The employment opportunities only last a

few months; however, during this period salaries are taxed and workforce buying power is bolstered. Potential costs for labor materials, rights-of-ways and related factors are detailed in Chapter 4. Depending on the size of the system being laid between 30 and several hundred jobs could be generated (Clark et al. 1978; New England River Basin Commission 1976).

Treatment Facility Construction

7.58 Oil and/or gas produced from a field in the Delta contains impurities and phases that must be removed or separated before the hydrocarbon can be delivered to an intermediate market such as a transmission pipeline. These operations are carried out at a treatment facility constructed for that purpose (Appendix A). Such a facility would consist of a series of unit operations to separate liquids, remove inert gases, and remove impurities such as hydrogen sulfide and carbon dioxide. Facilities must be available to handle the treated hydrocarbon, to store the recovered by products (sulfur, carbon dioxide) and to handle waste products.

Oil Partial Processing Plant

7.59 Construction activities would involve clearing of the area and construction of facilities.

7.60 Water Quality and Hydrology. Impacts from runoff and wastewaters would be the same types as those discussed for upland well completion. Oil and grease content would partially be a concern because the area needed for a partial processing plant is larger than the area needed for a well site, impacts could be more adverse due to a processing plant if not properly controlled. Wastewater could be discharged in one of a variety of ways in conformance with its required discharge permit obtained through the appropriate state environmental agency.

7.61 Upland Ecosystems. All biological productivity would be lost on 15 to 20 acres cleared during facility construction.

7.62 Groundwater. Impact to groundwater resources from construction of treatment facilities would be minimal and similar to those described for drilling site preparation in the Delta and upland regions.

7.63 Wastewater Disposal. Both runoff and wastewater are usually collected and treated at an oil processing plant. Federal treatment regulations for wastewater from oil processing must be followed (47 Federal Register, pgs. 46434-46457). A number of pollutants from a processing plant which are not commonly found in

sanitary wastewaters such as phenols, sulfide and chromium are controlled by Federal industrial treatment regulations and must be addressed as the facility is planned and installed.

7.64 Air Emissions. Air emissions associated with processing plants would be the same as those tabulated for the Mobile Delta.

7.65 Noise. Construction of treatment facilities produce noise. The U.S. Army Corps of Engineers, Mobile District (1982c) indicate that noise from gas plant construction would be "approximately the same" as onshore pipeline laying described in the above section (L_{eq} of 86 dB). Construction was expected to continue for approximately ten hours a day (U.S. Army Corps of Engineers, 1982c). Oil partial processing plant construction noise is assumed to be similar.

7.66 Solid and Hazardous Waste. Processing facility construction would result in land clearing waste of trees, stumps and other biomass, construction waste debris, and miscellaneous, leaks and spills of vehicle and equipment lubricants and fuel. The effects will be similar to those from construction of other similar sized industrial facilities.

7.67 Socioeconomic Characteristics. The mixture and relative concentrations of impurities in hydrocarbon resources determines the specific requirements of a partial processing facility. The lowest available estimate indicates that 15 acres per 100,000 barrels of oil per day would be needed for a plant to treat oil with associated gas, if gas processing facilities were located at the same site. If there were no gas processing, acreage would be reduced by about 40 percent (New England River Basin Commission, 1976). The building phase for a 15 acre plant would take about 15 months (New England River Basin Commission, 1976).

7.68 The potential effects resulting from construction could fall into the following categories: employment, personal income, land use and housing and community services.

7.69 Employment for between 10 and 85 individuals could be provided during the construction phase of a partial processing facility (Wales et al. 1976; New England River Basin Commission, 1976). The size and complexity of a facility would dictate the number of construction workers required. It is possible that more than half the workers could be local hires (U.S. Army Corps of Engineers, 1982a). The 1983 median weekly wage nationwide earned by those in the construction trade (excluding supervisors) was about $360 (U.S. Department of Labor, 1983). Based on this average and depending on the size of the labor force, between $3,600 and $30,600

dollars could be collectively earned weekly. Wages would then be circulated in the area economy bolstering personal income and tax revenues at all levels.

7.70 The amount of land used for a treatment facility also varies, from fewer than 15 acres to 50 acres or more. There are special location requirements. Processing facilities are generally near the pipeline landfall site (New England River Basin Commission, 1976). Within the coastal regions of Alabama and Mississippi there is currently ample room for industrial growth. However, there is still a potential for land use conflicts in the area at some point in the future.

7.71 Depending on the size of the treatment facility and its location respective to population centers, some inmigration of workers could result. In general, larger communities are better able to accommodate growth. To the extent that treatment plant construction workers locate in and around the major coastal population centers in Alabama and Mississippi, stress on existing resources would not be likely.

Gas Treatment Plant

7.72 Construction of a gas treatment plant would require clearing of the area and construction of facilities.

7.73 Water Quality and Hydrology. The impacts described for an oil partial processing plant apply to a gas treatment plant as well. Wastewater quantities would be much lower from a gas treatment plant than for an oil partial processing plant of similar size.

7.74 Upland Ecosystems. Construction of facilities would result in the loss of all biological productivity from 30-35 acres during the construction period. An additional 20 acres could be needed as a storage area for sulfur recovered from gas with a high hydrogen sulfide content.

7.75 Groundwater. Impact to groundwater resources from construction of treatment facilities would be minimal and similar to those described for drilling site preparation in the Delta and upland regions.

7.76 Wastewater Disposal. With smaller quantities of wastewater to manage than in an oil processing plant, treatment facilities would be smaller. Different treatment processes would probably be utilized as well. The Federal regulations for industrial treatment would need to be followed to the extent that those regulations have been formulated.

7.77 Air Emissions. Air emissions associated with processing plants would be the same as those tabluated for the Mobile Delta.

7.78 Noise. Noise generated by gas processing facilities would be about the same as onshore pipelaying activities.

7.79 Solid and Hazardous Waste. Construction activities would result in the following types of solid waste consisting of trees, stumps, and construction debris. Miscellaneous small leaks and spills from vehicles and equipment would also be likely.

7.80 Socioeconomic Characteristics. A gas treatment plant can require between 20 (Wales et al., 1976) and 75 acres of land (New England River Basin Commission, 1976). The area needed varies according to the constituents of the resource, the extent of processing that is to take place and the conditions under which the land is obtained. For instance, a currently proposed gas treatment plant in Mobile County, Alabama would occupy 33 acres within a fenced area of 120 acres. An additional 730 acres would be maintained as a residential buffer zone (U.S. Army Corps of Engineers, 1982a). This planned facility is unusual in the amount of land acquired.

7.81 The potential socioeconomic results from the construction of a gas processing facility would fall into the same categories outlined for an oil processing plant. A large structure, occupying up to 75 acres, could command a workforce of as few as 10 or as many as 500 people at the peak of construction activity (See Appendix F) (New England River Basin Commission, 1976). Such a large plant would take about a year and a half to construct. The proposed facility in Mobile County is expected to require a workforce of 350, 225 of whom could be local hires. Area employment and personal income would benefit from this activity. Based on the 1983 weekly median earnings for those other than supervisors in the construction trade between $3,600 and $180,000 could be paid out for labor each week (U.S. Department of Labor, 1983). It is likely that most of the labor would be local and wages earned would be circulated and taxed within the immediate vicinity. Land use conflicts would be unlikely if a plant were to be built in an industrial area but could occur at some point in the future. If inmigration results, the metropolitan areas would be likely to accommodate housing and infrastructure needs. The principal difference between potential effects generated by the construction of an oil processing facility versus a gas plant is in the magnitude of the effect. Details on the variables involved with gas plant sizes, designs and construction workforces are presented in Appendix F.

Normal Operations of Gathering System on Uplands

7.82 Normal operations of the upland portion of a pipeline gathering system involve maintenance of the right-of-way and inspection of the pipeline route for leaks.

Water Quality and Hydrology

7.83 Assuming pipeline rights-of-way are revegetated following pipeline installation, no impacts on water quality or hydrology due to normal operations are anticipated.

Upland Ecosystems

7.84 Pipeline corridors on uplands would be maintained so that trees and larger woody shrubs would not regrow, leaving grasses, vines, herbaceous growth and smaller woody shrubs. This community would be typical of successional communities on lands throughout Mobile and Baldwin counties.

Wastewater Disposal

7.85 No wastewater would be generated.

Socioeconomic Characteristics

7.86 The day to day operating requirements for a gathering system are minimal. Normal operations are highly automated and require only a small workforce for regular monitoring and right-of-way maintenance (Clark et al., 1978).

Normal Operation of Treatment Facilities

7.87 In the normal operation of an oil or gas treatment facility, an integrated system of unit operations is used for the separation of liquid and gas phases, removal of contaminants and the recovery, treatment, disposal or sale of by-products removed from the hydrocarbon stream.

Oil Partial Processing Plant

7.88 Impurities are removed from the raw crude oil stream at a partial processing plant. These impurities include formation water and natural gas, if present. Formation water is usually a brine containing dissolved and suspended solids. Natural gas, if present, may be separated from the oil stream at the well head or the treatment facility depending on the composition of the oil being produced. After partial treatment of the oil and natural gas, it is

delivered to an intermediate market such as a refinery or gas transmission company.

7.89 __Water Quality and Hydrology__. Runoff flow patterns and quality would be higher and more degraded respectively with a processing plant in place than if a plant was not in place. Small spills are unavoidable as is runoff of grease and oil from pavement and roof tops.

7.90 __Upland Ecosystems__. All biological productivity would be lost on land covered by structures, paved areas and crushed stone for the life of the facility.

7.91 __Wastewater Disposal__. Wastewater disposal options include discharge to the nearest water body, applying wastewater to the land and injecting wastewater to a deep formation. Much or perhaps all of the wastewater could also be treated and reused within the processing plant. The state environmental agency can control the method of wastewater disposal. Discharge to a water body and reuse are the two disposal methods most commonly utilized for oil processing wastewaters.

7.92 __Groundwater__. Although proper well casing should eliminate a direct interface between the production well and groundwater resources, there is a potential for interface through the disposal of oil field brine and treated fluids by underground injection. The procedure for drilling brine disposal wells and industrial waste disposal wells (in Mississippi) is similar to the drilling of oil and natural gas wells with the exception of casing requirements. Potential for aquifer contamination from drilling of disposal wells is the same as previously discussed for drilling of oil and gas wells. Wells should be drilled through all freshwater-bearing strata, and steel casing set in the bore hole from the surface to total depth to seal off and protect all formations above the objective stratum. The casing is bonded to the formations to prevent any movement of the injected fluid in the area between the casing and the wall of the bore hole. Conversion of abandoned oil and gas wells for use as disposal wells may be accomplished, provided overall casing requirements for disposal wells have been met, by perforating the in place casing at a predetermined injection zone. In addition to the casing and cementing requirements for oil and natural gas wells, Alabama requires cementing in Class II wells to a point at least 500 feet above the top of the injection interval. All injection plans should include consideration of abandoned wells in the formation which, if near to a highly pressurized injection well, could become unplugged and provide a conduit for loss of formation and injected fluids and create possible groundwater contact (Alverson, 1970). As during

well completion, potential for groundwater contamination may also exist during any fracturing efforts.

7.93 Air Emissions. Air emissions associated with normal operations would be the same as those described for Mobile Bay and Mississippi Sound.

7.94 Noise. Noise sources at a partial processing plant are pumps for operating pressure (80-90 dB at operator's position), flarestacks at vapor incinerators (81-96 dB at 20 feet), and treating vessels for separation of water and oil (81-96 dB at 20 feet). As in the case of gas plants, oil partial processing plant operation would continue 24 hours per day.

7.95 Solid and Hazardous Wastes. According to the New England River Basin Commission (1976), solid wastes which are likely to result from an oil partial processing plant include:

- Sedimented materials, either produced with crude oil or precipitated during storage;
- Sludge, scums, and froth from the treatment of the crude oil brine; and
- Various combustible materials, debris, and trash.

Sedimented sludges are periodically removed from the bottom of the storage tanks and pipelines in order to maintain partial processing, throughput and storage. Iron rust, iron sulfides, sand, and oil are the major constituents of these sludges which are normally stored for subsequent treatment, oil reclamation and disposal. These wastes as well as the debris and trash generated at a partial processing plant contain no hazardous materials. Cleanouts of tank bottoms and piping are performed infrequently, perhaps every ten years, and the sludge volumes are not large.

7.96 Sludges produced during partial processing activities may contain phenol, benzene, ammonia, and heavy metals such as iron and aluminum compounds. Many of these wastes, if generated in sufficient quantities to implement the provisions of the Resource Conservation and Recovery Act (RCRA), are classified as hazardous wastes requiring state or U.S. Environmental Protection Agency approved storage, transport, and disposal.

7.97 Large quantities of chemical waste slurries can be produced at partial treatment facilities in oil/brine separation and wastewater treatment processes. These include oil, organic and inorganic acids, bases, mercaptans, sulfides, and high

concentrations of gummy sulfur, oxygen, and nitrogen compounds. For example, when ferric chloride is used to remove oil from water, approximately four cubic feet of sludge is generated for each pound of chemical used. The 30 to 500 pounds of ferric chloride used daily to treat 10,000 barrels of water to obtain 20 parts per million of oil in the discharge water would result in 120 to 2,000 cubic feet of sludge (New England River Basin Commission, 1976).

7.98 Present upland partial treatment facilities in the vicinity of the project area typically use physical processes for oil, water and gas separation. Future projects contemplate similar applications with no production of waste slurries or sludges (Walk, Haydel and Associates, 1983; Johnson. Personal communication, 1983; Brantingham. Personal communication, 1983).

7.99 Other elements of the oil partial processing plant process such as stormwater collection, cooling water, and sanitary wastes discharge waste streams are not classified as hazardous.

7.100 Socioeconomic Characteristics. Employment opportunities drop dramatically once a processing facility is in operation. However, the job possibilities are not transient, they are permanent. Plants generally operate on 3 shifts. A facility handling a combined oil and water throughput rate of 43,000 barrels per day could operate with a total of 7 people (New England River Basin Commission, 1976). At $30 per barrel such a plant would be processing almost $1.3 million per day of oil. Assuming an average salary of $20,000 annually $140,000 could be earned, taxed and circulated by local residents (U.S. Army Corps of Engineers, 1982a).

Gas Treatment Plant

7.101 During the operation of a gas treatment plant, impurities are removed from the gas stream so that the gas can be delivered to the intra- or interstate transmission system. Impurities removed include liquifiable hydrocarbon fractions, if present (wet gas), and hydrogen sulfide (sour gas). Gas in the more southern portion of the study area is currently expected to be quite dry (small liquifiable fraction) and have a hydrogen sulfide content of about 10 percent.

7.102 Water Quality and Hydrology. Runoff flow and quality are altered compared to no-development conditions as discussed for an oil partial processing plant.

7.103 Upland Ecosystems. All biological productivity would be lost on land covered by structures, paved areas and crushed stone for the life of the facility. Biological effects within the buffer

zone around the treatment facility would depend on the actions of the treatment plant operation. If left alone, these areas remain as is or undergo biological succession typical of the area.

7.104 Groundwater. Little possibility of impact to the groundwater resources is expected from the normal operation of a gas treatment plant. Only small amounts of liquids are expected and disposal of them in Class I wells is being discontinued.

7.105 Wastewater Disposal. The disposal options discussed for an oil partial processing plant apply to a gas treatment plant as well. Wastewater quantities are smaller and effluent quality differs from an oil processing facility.

7.106 Air Emissions. Air emissions from treatment plants are identified in Chapter 4 for the Mobile Delta.

7.107 Noise. Gas plants use various noise producers during gas treatment, including compressors (92-100 dB at operator's position), boilers (90 dB at 6 feet), flarestacks (81-96 dB at 20 feet), and mechanical scrubbers (New England River Basin Commission, 1976). Because gas plants operate continuously, noise levels would continue 24 hours per day.

7.108 Solid and Hazardous Wastes. Gas processing facilities produce various solid wastes including combustible paper and cardboard, processed sludge containing chemicals and residuals from brine evaporation. Accidental spills of liquid gas or other hydrocarbons are also a possibility. Specifically, according to the New England River Basin Commission (1976), the following wastes may be generated:

- Equipment cleaning rags (disposable);
- Waste paper and paper cartons;
- Sanitary wastes (kitchen, change room trash, etc.);
- Spent cartridges from water coalescers and glycol, oil and fuel filters, etc.;
- Floor cleaning compounds, oil absorbents, and equipment cleaners;
- Scrap metal from equipment repairs;
- Non-returnable chemical and lubricating oil drums;
- Spent "iron sponge" (iron oxide and wood chips) material used to sweeten sour gas streams;
- Scale and sludge from boiler cleanouts;
- Scale and sludge from cooling tower cleanouts;
- Tank cleaning sludge (oily wastes, solids, and scale);
- Filtration media such as diatomaceous earth, sand, gravel, and other filter-bed material;

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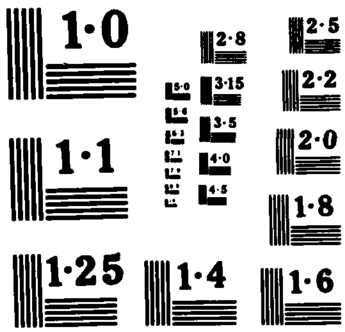

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- Plastic and rubber wastes (packaging, gaskets, filter material, etc.);
- Spent desiccant;
- Spent sieve material;
- Contaminated sulfur; and
- Contaminated catalyst.

7.109 Some of these materials are classified as hazardous under the provisions of the Resource Conservation and Recovery Act and would require state or U.S. Environmental Protection Agency approval for storage, transport, and disposal if generated in sufficient quantities. A few tons per year of these materials are produced at a gas plant. At one plant near the project area solid wastes are segregated into bins for non-hazardous and hazardous (really not otherwise specified items such as used oil filters). Several times a year the bins are emptied by licensed disposal contractors (Freiberg, 1983).

7.110 A proposed 225 mmcfd sour gas processing plant in the project area is estimated to generate 7 gallons per minute of high sulfide (31,000 mg/l) and high total dissolved solids (TDS) (116,000 mg/l) waste, small amounts of hazardous laboratory wastes, and approximately one barrel per day of semisolid hazardous waste from the Sulfinol process (designed to remove hydrogen sulfide and carbon dioxide from the natural gas)(Mobil Oil Exploration and Producing Southeast, Inc. 1981b).

7.111 The estimated hazardous sulfinol waste production appears to be conservatively high. Both sulfinol and amine processes for sour gas treatment can operate with very low hazardous waste production, and some plants have operated for several years without disposing of any sulfinol or amine regenerator wastes (Carlisle, 1983).

7.112 Natural gases containing little hydrogen sulfide also occur in existing fields adjacent to the project area. Physical processes are used for gas-water separation, and in some the sulfur is incinerated and vented up tall stacks (Brantingham, 1983).

7.113 For infrequent cleanouts, hydrocarbons may be drained from various treatment vessels into lined pits from which they evaporate or are collected for reclaiming.

7.114 Socioeconomic Characteristics. A typical gas processing plant (50 to 300 mmcfd capacity) could employ between 15 and 35 skilled individuals including supervisors, technicians, operators, electricians and maintenance personnel. For a large plant (500 mmcfd capacity) as many as 55 individuals could be needed (Frieberg,

1983; Clark et al., 1978; U.S. Army Corps of Engineers 1982a; New England River Basin Commission, 1976). It has been estimated that about 60 percent of a gas plant's operating personnel could be locally hired (Clark et al., 1978). Assuming an annual salary of $20,000 per person during operations between $300,000 and $1.1 million could be paid out annually in wages (U.S. Army Corps of Engineers, 1982a). If gas were valued at $3.45 per million Btu's a 50 mmcfd plant would process about $172,000 per day of the resource (Burroughs, 1983).

7.115 The proposed Mobil Oil gas processing plant in southern Mobile County is expected to employ about 27 people, 10 of whom would be hired locally. Their sulfur depot would employ an additional 7 individuals, 3 of them from the local area (U.S. Army Corps of Engineers, 1982a). Although the number of job possibilities are dramatically reduced during day-to-day operations compared to the construction period, the employment is permanent.

Well Workover at an Upland Well Site

7.116 At periodic intervals throughout the life of a well, it may be necessary to perform well workover services in order to maintain production from the well. A well workover rig similar to the original well drilling rig would be brought to the site. Activities carried on at the site during well workover could be of a comparable magnitude to the original operational drilling phase. Workover may require several weeks to complete. The effects resulting from well workover activities would be virtually the same as those described for the drilling phase at an upland well site.

Enhanced Recovery Activities Occurring on Uplands

7.117 The initial flow of oil from a well is driven by the natural pressure of gas or water in the geological formation. As the reservoir is depleted, however, this natural flow ends or becomes greatly reduced, so that production from the well must be enhanced by some artificial means. Some techniques such as gas lift or pumping utilize the production well itself. Other techniques are to inject fluids or gases into the formation to force the hydrocarbon towards the wells. Portions of enhanced recovery facilities would be constructed and operated both within the wetland or aquatic environments of the study area and on adjacent uplands. In general, facilities for generating or storing material used for enhanced recovery would be constructed at an upland location.

Gas Lift

7.118 Gas lift involves the injection of a gas at the bottom of the well to increase the buoyancy of the fluid column. The source of gas could be placed at an upland location and delivered to the well by pipeline.

7.119 Water Quality and Hydrology. No impacts due to gas lift operations in particular are anticipated which have not been discussed for well site preparation and gathering system construction. Runoff characteristics would be altered as a result of site clearing and construction. Unavoidable spills of small amounts would also occur.

7.120 Upland Ecosystems. If a new gas injection well is drilled to continue flow at the production well, then an area of less than 1 acre would be cleared in the same manner as for an exploratory or production well. Similarly, if a pipeline is needed to deliver the gas to a well location, then an area of 1 to 1 3/4 acres would be cleared per 1000 feet of line. In either case, the vegetation cleared would result in loss of wildlife for the life of the project.

7.121 Groundwater. Impacts from enhanced recovery activities are the same as described for the Delta region.

7.122 Wastewater Disposal. Sanitary wastes, produced waters and mud liquids would need to be managed. Wastes would be handled on-site or transported to a municipal system. Produced waters could be re-injected to a deep formation or treated and properly disposed. Mud liquids can be stored at an upland site and properly treated and disposed.

7.123 Air Emissions. Air emissions from enhanced recovery would be the same as those described for Mobile Bay and Mississippi Sound.

7.124 Noise. Gas lift procedures for enhanced oil/gas recovery in upland areas are comparable, in terms of noise, to those accounts presented for the Mobile River Delta. Noise would primarily be attributed to compressors and/or pumps.

7.125 Solid and Hazardous Wastes. Impacts from enhanced recovery activities are the same as described for the Delta region.

7.126 Socioeconomic Characteristics. Gas lift could require new pipeline construction. Initially, the gas in the oil producing formation could be separated from the crude at a processing

facility, travel back to the field via the pipeline and be reinjected in the well, stimulating the oil flow to the top. If a new pipe had to be laid effects like those described in sections pertaining to the wetlands and uplands would result (Chapter 4). A new pipeline does not necessarily have to be constructed. A spare line could have been included during the initial stages of pipeline construction at the development phase. Once the system is in operation, few employees would be required since the system would be highly automated (Haney, 1983. Personal communication).

Material Injection

7.127 Oil can be driven or carried to the production wells by injecting materials into the formation. These materials could include water, solvents, treating chemicals, steam or gases. Material injection could be through existing production wells converted to injection wells and/or through new wells drilled strictly for injection purposes. The source of the injected material could be built and operated at an upland location.

7.128 Water Quality and Hydrology. Impacts would be of the same type as for gas lift facilities: runoff and unavoidable spills.

7.129 Upland Ecosystems. The effects of this activity would be the same as the effects of a gas lift system. In certain cases. the volume of material to be injected may be stored at the site and require clearing an additional 1/4 acre area.

7.130 Groundwater. Impacts from enhanced recovery activities are the same as described for the Delta region.

7.131 Wastewater Disposal. Wastewaters and waste chemicals would need to be treated on-site or off-site and properly disposed.

7.132 Noise. Noise emission would be the same as those described for the Delta.

7.133 Solid and Hazardous Wastes. Impacts from enhanced recovery activities are the same as described for the Delta region.

7.134 Socioeconomic Characteristics. Based on existing discoveries, the most likely material that could be injected during secondary recover in Delta oil fields is water. Water injection facilities are relatively simple. As in gas lift a pipeline would be needed in addition to storage tanks, a pumping system (Haney, 1983. Personal communication). If salt water were used, the source would probably be that which is extracted with the oil from the

formation well. Separation would take place at the treatment facility where chemicals may be added for maximum efficiency.

7.135 The addition of tanks and a pumping system would require a small construction work force. The placement of the accouterments would likely be at an existing treatment facility serving the field (Haney, 1983. Personal communication). Once the system was in operation only one or two individuals would be needed for maintenance.

7.136 If enhanced recovery were to take place at a field with a history of abundant production, nitrogen injection could be employed. It is an expensive process, which would not be justified for smaller fields. A facility designed to extract nitrogen from the atmosphere and harness the gas for injection would require an area no larger than 2 acres. The construction and operation requirements would be similar to those involved with a gas treatment facility. If a new pipeline were needed the activities previously described would pertain.

7.137 Injection of CO_2 is generally used in fields with low gravity crudes. If used, CO_2 would probably be trucked in liquid form; a holding facility would be needed. Space at an existing treatment facility would likely be used. As in other cases, the possibility for constructing a pipeline or drilling a well for injection exists. If one or the other is needed the requirements and effects described for these activities in Chapters 4 and 5 would apply.

Service Bases

7.138 Service bases for drilling operations require berths for supply and crew boats, dock space for loading and unloading, warehousing and open storage areas, and space for supervisory and communications personnel. Public and private port facilities are used as service bases; they are generally leased on a short term basis and occupy 5 to 10 acres (Clark et al., 1978; New England River Basin Commission, 1976). Depending on the service level of an existing facility, improvements may or may not be needed. Most of the land at a temporary base is used for open storage such as tubular goods, drilling supplies and parking. If there is inadequate housing for communications and office duties, house trailers may be moved on site. Depending on the number of rigs served by a facility, warehouses could be required. In this event, a small construction work force of about 20 workers (Clark et al., 1978) would be needed to erect the structures. Most construction workers could be locally hired.

7.139 An existing service base at Bayou La Batre, for instance, was improved over a six month period. Several rigs are serviced from this facility; it is rented from the city (Pilie, 1983. Personal Communication). Another service base leased by the operator from a private firm across from the Port of Mobile is primarily used for open storage. Only a dispatcher and a security guard comprise the workforce; major improvements have thus far been unnecessary.

7.140 Converting a temporary service base to a permanent one during appraisal and production drilling could require a maximum workforce of 90. An operator could need between 50 and 100 acres which would leased on a long-term basis or purchased outright (Clark et al., 1978).

7.141 Noise sources related to service base activities include basic construction noise from sources such as cranes, generators, pneumatic tools, saws, and forklifts. Noise levels from this machinery is detailed in Chapter 4. Additional noise would emanate from various trucks, automobiles and other vehicles. If located at a port, marine traffic and signals would also contribute to the service base noise level.

7.142 Noise emissions at the service base may be somewhat masked if located in an existing port or other industrialized area with an already elevated ambient noise level.

7.143 Construction is similar to other docking and supply facilities and solid wastes consist of construction debris and spoil. Solid wastes generated by well site hydrocarbon exploration and production activities have been described in previous sections. According to the New England River Basin Commission (1976), solid wastes generated by service base operation include dunnage (material used to protect cargo) collected during boat unloading, garbage from supply and crew boats (approximately 6.5 lbs per person per day), and garbage/refuse from service base employees.

Transport of Resource to Intermediate Market

7.144 Following treatment to remove contaminants (corrosion inhibitors, hydrogen sulfide) or to separate liquid and gas phases, the hydrocarbon resource is transported to an intermediate market. Oil would be transported by pipeline directly to a refinery or to a tie in with a regional crude oil pipleline. Gas would also be transported by a pipeline to a tie in with a regional gas pipeline. Condensates would be transported by tanker truck to a destination designed by the purchaser.

Pipeline Construction

7.145 Construction of a pipeline to transport oil or gas from a treatment plant would basically include the same operations as construction of a gathering system. The operations would proceed from right-of-way surveying and clearing to trenching and pipe-laying to backfilling and seeding. For a 50 to 75 foot right-of-way, an area of 1 to 1 3/4 acres would be cleared per 1000 feet of pipeline.

Pipeline Operation

7.146 Normal operations of the pipeline would involve maintenance of right-of-way and periodic inspection of the pipeline route for leaks. The checking for leaks may be done on the ground or from aircraft flying the pipeline route. To provide continued ground access to the pipeline route, periodic maintenance is performed to prevent the regrowth of trees and larger woody shrubs.

Batch Transport

7.147 Production of gas is often accompanied by the production of condensates, light hydrocarbon liquids (butane, propane, pentane) formed by the condensation of hydrocarbon vapors. This commodity is generally stored in tanks at the treatment facility until sold to a customer who would transport the condensates via tanker truck.

Cultural Resources

7.148 The potential impacts to the cultural resources of uplands due to production operations are similar to those impacts associated with drilling operations. Any production activity that produces surface disturbances has the potential for impacting historical or archaeological sites. In production operations, these activities include the installation of a gathering line system and well drilling in previously undisturbed areas for enhanced recovery operations. Dependent on jurisdictional requirements for production operations in uplands, one or more levels of cultural resources investigations may be required.

Accidental Release of Natural Gas Containing Hydrogen Sulfide

7.149 Potential effects resulting from an accidental release of gas containing hydrogen sulfide would be the same as those described in Chapter 4.

ABANDONMENT

7.150 When the economically productive life of the field is over the field would be abandoned. Upland wells would be plugged with cement and the surface casing out off below the surface in accordance with Mississippi and Alabama Oil and Gas Board regulations. Wellsite equipment would be removed. Pipelines would be emptied of fluids and abandoned in place. Treatment and processing plants would be dismantled or sold.

Upland Well Site

7.151 Abandonment of an upland well site would require the plugging of the well and removal of equipment associated with the well head and well site.

Water Quality and Hydrology

7.152 As vegetation at the site reverts to predevelopment conditions, runoff, flows and erosion would reduce and water quality would be enhanced back toward pre-development conditions. Runoff water quality may not improve, however, if residual materials and chemicals at the site continue to add synthetic compounds to runoff streams.

Upland Ecosystems

7.153 Restoration of upland well sites is regulated by the Alabama and Mississippi Oil and Gas Boards and by the lease agreement with the landowner. Typically the area around the well might be regraded and the area reseeded to reduce erosion. The regrowth that occurs and the type of vegetation community that develops would depend on the use made of the land by the landowner.

Groundwater

7.154 Abandonment activities will have minimal impacts on the groundwater resources and are similar to those described for the Delta region. Improper plugging of the well presents the most potential impact.

Wastewater Disposal

7.155 No wastewaters would be generated once the well site facilities have been completely abandoned.

Air Emissions

7.156 Air emissions resulting from abandonment would be the same as those identified for Mobile Bay and Mississippi sound.

Noise

7.157 Abandonment procedures for upland well sites would be comparable to those described for the Mobile River Delta.

7.158 Pipeline abandonment would also be treated similarly to descriptions for the Mobile River Delta in Chapter 4, although vehicles (truck/auto) would replace any boats used in the Delta.

Solid and Hazardous Waste

7.159 The result of abandonment in terms of solid waste production is a volume of unsalvageable construction materials and debris as well as production residues. Materials such as sediment from settling and storage tanks and separators must be removed for treatment and disposal at approved facilities. In some cases, accumulated scrap and residues may be burned on-site subject to air pollution regulations. Linings are removed from brine collection pits or burning pits and the pits are filled in. Some other minor leveling of protective basins, grading, and revegetation may be done.

Socioeconomic Characteristics

7.160 The principal effect from abandonment is the loss of public revenues derived from state severance taxes and the loss of royalties. Potential income from these sources from oil and gas wells are described in Chapters 4 and 5. The dismantling of equipment would require a small workforce employed temporarily. Depending on stipulations in a lease, site restoration could also require a small workforce. Employment from this phase would be brief however. Thus, the major effect would be the loss of revenues.

Pipelines

7.161 Pipelines to be abandoned would be drained and flushed. The lines would most likely be abandoned in place.

Water Quality and Hydrology

7.162 As vegetation reverts back to pre-development conditions, quantities of runoff would probably decline as runoff water is better able to infiltrate the soil. Less erosion due to runoff would also occur.

Upland Ecosystems

7.163 Upon abandonment, pipeline corridor easements would be terminated or the land sold, if owned outright by the producing company. Vegetation maintenance activities would cease. The vegetation community that develops on the right-of-way would be determined by the landowner.

Wastewater Disposal

7.164 Sanitary wastes from employees during abandonment and fluids flushed from pipelines would need to be properly collected, treated and disposed. The flushed fluids may not necessarily be compatible with wastewater entering a municipal wastewater treatment plant.

Socioeconomic Characteristics

7.165 Pipeline abandonment in the uplands would probably require a small crew to flush the pipes. No appreciable effects would result from this activity.

Treatment Facilities

7.166 Treatment facilities would be sold for a similar use, the site converted to some other industrial use, or the structures removed. Restoration of the land would be determined by the landowner if the property is leased, the conditions of the sale if ownership is transferred, or the intended future use of the land.

Service Bases

7.167 After field abandonment, service and operating bases would be relinquished. If the operator staged activities from a service company dock, the space would be relinquished. If the dock was leased it would be sublet or the lease would be terminated. If owned, the area would probably be sold or leased.

7.168 The eventual role of service bases, and the fate of the surrounding communities, is a concern of coastal states (Havran and Collins, 1980). It is thought that many such bases could continue in use as centers for marine transportation, commercial and sport fishing, fish processing, wood processing or as industrial parks (Havran and Collins, 1980). Depending on the nature and timing of converting bases to other uses, and the businesses that substitute, socioeconomic effects could be significant on employment, personal income, and taxes. Further, depending on the size of the workforce that leaves, and the one that substitutes, it is likely that little

if any effect would be noticed on land use. Even if a former service base were to be expanded it is probable that it would already exist in an industrial setting.

CHAPTER 8

ENVIRONMENTAL CONSEQUENCES OF REGIONAL RESOURCE DEVELOPMENT SCENARIOS

INTRODUCTION

8.1 The future environmental effects of oil and gas exploration and production activities in coastal Alabama and Mississippi will be a function of all the activities occurring together in the region at any time. In general, several activities will be occurring concurrently, such as drilling and production, and construction and operation activities. The amount and intensity of activity will be a function of the quantity of hydrocarbon resource that can be recovered, the timing of the leasing of public waters and private lands, lease exploration and development schedules established by the lease holders, and future factors affecting the hydrocarbon market. Discussed below are the potential environmental consequences of a range of possible future hydrocarbon exploration and production levels in the study region.

Approach to the Analysis

8.2 The analysis is based on an estimate of the recoverable hydrocarbon resource in the region (Appendix B), scenarios for development of these resources (Appendix C) and the environmental loadings of the unit actions (Chapters 4 through 7). The resource development scenarios establish upper and lower limits on the level of concurrent activities that could occur in each subregion over the next 30 years, based on certain assumptions about the timing of resource discovery and schedules of resource production. The development scenarios are not predictions of what will happen in the future. They merely establish limits within which future development is likely to occur.

8.3 The concurrent resource development activities by year are used to determine environmental alterations that could result from these activities. Several examples are habitat area disturbed over time, the effect of habitat disturbance on regional ecosystems, labor force required and the socioeconomic effect of these requirements, regional air and water quality, and environmental and safety considerations of accidents.

Organization of Chapter

8.4 Analyses in this chapter have been carried out on both a subregional and region-wide basis as appropriate. First, brief summaries of the regional hydrocarbon resource estimate and the hydrocarbon resource development scenarios are presented with

details given in Appendices B and C. Next, the analysis of effects to the physical and biological environments of the four subregions (Mobile Delta, Mobile Bay, Mississippi Sound and state waters of the Gulf of Mexico) and the adjacent upland environments is presented in a section for each subregion. Also presented in the final uplands section are analyses of several factors that have been carried out on a region-wide basis. These are air quality, brine disposal, solid and hazardous waste, and socioeconomic characteristics.

REGIONAL HYDROCARBON RESOURCE ESTIMATE

8.5 Estimates have been made of recoverable hydrocarbons in the Mobile Delta, Mobile Bay, Mississippi Sound, state waters of the Gulf of Mexico and adjacent federal waters of the Gulf of Mexico which would be serviced from the study region and from which pipelines and treatment facilities would be constructed in the study region. For areas within the study region the following sources of information were used:

- o Published scientific literature.
- o Discussions with state and federal agencies.
- o Examination of selected well logs.
- o Proprietary industry reports.
- o Proprietary seismic records.

For the area under adjacent federal waters, estimates were made based on general knowledge of the region and estimates given by the U.S. Department of the Interior (1983c). The federal area of interest was defined as the Mobile Area, the portion of the Pensacola and Destin Dome areas south of Alabama state waters, and the Viosca Knoll Area bounded by the Mobile, Destin Dome, Chandeleur and Main Pass East Addition Areas. Additional information on the resource estimate methodology and results is given in Appendix B.

8.6 The estimates of recoverable hydrocarbon resources in the study area and adjacent federal waters are given in Table 8-1. The majority of the resources within the study area are likely to be found in the Alabama portion because of the presence of the stable Wiggins Arch that extends east-west from Louisiana to the western side of Mobile Bay. For the high and moderate estimates the quantity of oil and gas under the adjacent federal waters could be several times that under the study region. For the low resource estimate case the quantities in the study region and the federal waters could be similar.

8.7 This paragraph has been deleted in the FEIS.

TABLE 8-1

ESTIMATE OF RECOVERABLE HYDROCARBON RESOURCES IN THE STUDY REGION AND ADJACENT FEDERAL WATERS

Location	Resource	Units	Estimate of Quantity[a] High	Moderate	Low
Mobile Delta[b]	Oil	MM bbl	130	88	60
	Condensate	MM bbl	330	260	213
	Gas	Tcf	2.2	1.8	1.5
Mobile Bay[c]	Oil	MM bbl	13	0	0
	Condensate	MM bbl	440	110	87
	Gas (Tcf)		3.3	2.6	2.1
Mississippi Sound	Oil	MM bbl	5	0	0
	Condensate	MM bbl	22	4.4	1.3
	Gas	Tcf	1.1	0.32	0.09
Alabama Waters of the Gulf of Mexico[d]	Oil	MM bbl	55	0	0
	Condensate	MM bbl	14	6.2	2.9
	Gas	Tcf	1.1	0.51	0.23
Mississppi Waters of the Gulf of Mexico	Oil	MM bbl	0	0	0
	Condensate	MM bbl	25	0	0
	Gas	Tcf	0.88	0	0
Total Delta and State Waters	Oil	MM bbl	200	88	60
	Condensate	MM bbl	830	380	300
	Gas	Tcf	8.6	5.2	3.9
Federal Outer Continental Shelf	Oil	MM bbl	610	340	71
	Condensate	MM bbl	400	220	42
	Gas	Tcf	28	15	1.7
Total State plus Federal	Oil	MM bbl	810	430	130
	Condensate	MM bbl	1200	600	350
	Gas	Tcf	37	20	5.6

OCS = Outer Continental Shelf
MM bbls = Million barrels
Tcf = Trillion cubic feet

[a]Includes stratigraphic traps
[b]Includes Movico Field
[c]Includes Mary Ann Field
[d]Mary Ann Field included in Mobile Bay estimate

HYDROCARBON RESOURCE DEVELOPMENT SCENARIOS

8.8 Hydrocarbon resource development scenarios have been prepared to provide a quantitative basis for estimating the cumulative impacts of developing and producing the commercial hydrocarbon resources of the Mobile Delta, Mobile Bay, Mississippi Sound, state territorial waters of the Gulf of Mexico, and adjacent federal waters. The scenarios are based on the amounts of hydrocarbon resources identified in the resource estimate (Appendix B) and alternative time frames for discovery, development and production activities as they occur in sequence during the course of individual field development. Using these scenarios, an estimate can be made of the cumulative impacts arising from all the activities required to develop the resource base of the study area and adjacent federal waters.

8.9 The resource development scenarios are given in Figures 8-1 through 8-6 (end of chapter). An explanation of each activity plot is given in Table 8-2. A summary of the development cases considered and the resources to be recovered for each case is given in Table 8-3.

8.10 Neither the resource development scenarios nor the resource estimates on which they are based constitute a prediction of how much of, or by when, the region's resources will be discovered, developed and produced. Rather, the scenarios are intended to provide operational upper and lower limits on potential future activity levels so that environmental analysis can be carried out. The actual future course of development falling within these limits would depend on a variety of factors, among which are further demonstrations of the actual geological potential of the region (results of future drilling and reservoir/field life characteristics), market and economic factors, leasing policies and schedules, and specific technical limitations associated with development and production--all of which are difficult, if not impossible, to predict accurately over the study period.

ENVIRONMENTAL CONSEQUENCES IN THE MOBILE DELTA

8.11 Discussed in this section are the potential effects associated with the hydrocarbon resource development scenarios on the biological and physical resources of the Mobile Delta.

TABLE 8-2

ADDITIONAL ASSUMPTIONS REGARDING
THE HYDROCARBON RESOURCE DEVELOPMENT SCENARIOS
IN FIGURES 8-1 THROUGH 8-6

Plot	Comments
Gas Production	Annual volume of natural gas produced in that subregion.
Oil and Natural Gas Liquids Production	Annual volume of oil and natural gas liquids produced in that subregion.
Drilling Locations Established	New surface locations established for drilling in each year in that subregion. Subsequent wells drilled at each location would not constitute a new drilling location being established. Installation of drilling platforms at an existing location would be a new disturbance at that site.
Active Rotary Rigs	Maximum number of drilling rigs operating at the same time during each year in that subregion.
Active Workover Rigs	Maximum number of workover rigs operating concurrently during each year in that subregion.
Wells Started	Total number of wells started in each year in that subregion.
Wells Reaching Total Depth	Total number of wells reaching their planned depth in each year in that subregion.
Well Footage Completed	Total length of all wells drilled during the year in that subregion.
Total Miles of Pipeline Installed	Annual total miles of new pipelines installed within the subregion in each year. Mileage includes pipelines originating from the wells in that subregion and the portion of pipelines crossing the subregion that originate in an adjacent subregion. Not included are pipelines from federal waters.
New Gas Processing Capacity Installed	Processing capacity constructed in each year for gas originating in that subregion only.
Activities in Federal Waters (Figure 8-6)	Estimates of pipeline miles are those miles that that would be constructed within adjacent state waters and lands. These miles would be in addition to pipeline miles given in Figures 8-1 through 8-5. Gas treatment plant capacity given is that necessary to treat gas brought to shore in Alabama and Mississippi.

TABLE 8-3

TYPES OF HYDROCARBONS RECOVERED FROM EACH SUBREGION FOR EACH RESOURCE DEVELOPMENT CASE[a]

Subregion	Resource Development Case[b]		
	High Resource Quantity Estimate, 90% Discovered in 10 Yrs	Moderate Resource Quantity Estimate, 90% Discovered in 15 Yrs	Low Resource Quantity Estimate, 90% Discovered in 15 Yrs
Mobile Delta	Oil, Gas, Condensate	Oil, Gas, Condensate	Oil, Gas, Condensate
Mobile Bay	Oil, Gas, Condensate	Gas, Condensate	Gas, Condensate
Mississippi Sound	Oil, Gas, Condensate[c]	Gas, Condensate	Gas
Alabama Waters of the Gulf of Mexico	Oil, Gas, Condensate	Gas, Condensate	Gas
Mississippi Waters of the Gulf of Mexico	Gas, Condensate	No Resource	No Resource
Federal Waters of the Gulf of Mexico	Oil, Gas, Condensate	Oil, Gas, Condensate	Oil, Gas, Condensate

[a]See Appendix B for a discussion of resource distribution assumptions.

[b]See Appendix C for discussion of resource development cases.

[c]90% discovered in 15 years. Jurisdiction over portions of Mississippi Sound which lie within Alabama and Mississippi state boundaries is contested with the Federal Government. Until settled, this dispute would delay leasing activities in these portions of Mississippi Sound.

Water Quality and Hydrology

Worst Case

8.12 The greatest cumulative effects in the Delta would occur from the long-term presence of canals and slips--19 canals and slips in the worst case. The most widespread possible effects from so many canals could be changes in wetland erosion patterns. Surface water hydrology would not be drastically affected by canal development as long as no canal connects two distributaries, thereby providing a new channel. Such connections have caused significant problems in Louisiana deltas (Lee, 1983) but are not expected to be allowed in the Mobile River Delta. Surface water quality, however, may be affected by possible oxygen depletions in stagnant bottom waters of the canal and by salinity intrusions into canals located in the lower Delta.

8.13 Isolated dredged areas, such as canals and slips with only one connection to a river channel, act as sedimentation basins. Organic material trapped from the river or washed off the surrounding wetlands can accumulate on the canal bottom and support biological activity that consumes the dissolved oxygen in the bottom waters. With little exchange between river and canal and limited circulation within the canal, little reaeration occurs and the dissolved oxygen concentrations can drop below 5 mg/l--the Alabama water quality standard for dissolved oxygen for fish and wildlife. Some of this water with low dissolved oxygen is apt to bleed into the river, but the effects upon mixing with the larger water volumes of the river channel would be localized. Overall cumulative impacts, therefore, would be limited to the 19 canals scattered throughout the Mobile River Delta, with the water quality standard for dissolved oxygen possibly being violated in each canal's bottom waters and with erosion of adjacent wetland soils. Any migratory species which are sensitive to dissolved oxygen changes and which migrate to any of these canals could be adversely affected, if they are unable to modify their migration paths.

8.14 During periods of prolonged low river flow, a salt wedge from Mobile Bay moves into the four primary river channels extending from Mobile Bay upstream into the Delta. A typical stratified estuarine situation is created with fresh water flowing downstream on the surface and denser, high salinity Bay water moving upstream in the bottom waters. In the summer of 1982, the Alabama Department of Environmental Management ran synoptic surveys to track the movement of the salt wedge up the Mobile River channel. As expected, as the summer passed, river flows from upstream decreased, and the salt wedge moved farther upstream, reaching its maximum penetration during the last week of the survey, September 18-23. During that week the river flow from upstream reached a minimum of

8,500 cfs, close to the estimated 7-day, 10-year low flow of 8,000 cfs. Salinity contours along a profile of the river on September 23 are shown in Chapter 3. If the canals for oil production are seven feet deep, the salt wedge (defined here somewhat arbitrarily as the 5-ppt contour) could move into the bottom of any canals below river mile 15. The canals would not affect movement of the salt wedge up the river channel, but they could carry the salt wedge deeper than normal into the Delta wetlands. This could have concomitant effects on groundwater and vegetation. This salt water intrusion would only occur during low flow periods because at normal or high flows the salt wedge is too deep in the river channel to spill over the canal sill.

8.15 The worst case conditions for the moderate resource scenario is qualitatively the same as that for the high resource scenario, (i.e., canal and slip site development at all development locations). The cumulative impacts on surface waters would be the same--violations of the water quality standard for dissolved oxygen and possible intrusion of the salt wedge--but they would occur in only 10 canals and slips instead of 19.

8.16 The worst case condition for the low resource scenario is the same as that for the moderate and high resource scenarios: canal and slip development at all sites. Qualitatively, the cumulative surface water impacts are also the same (low dissolved oxygen and possible salt wedge intrusion in the bottom waters of the canals). Quantitatively, the extent of impact for the low resource scenario is virtually the same as that for the moderate resource scenario, because only one less site, nine instead of ten, would be developed.

Best Case

8.17 The best case condition is the combination of unit actions causing the least cumulative impact on surface water quality or hydrology. Site development with trestle roads or aerial access to a well site is considered to have the least cumulative impact because there would be no canal development and there would be no significant surface water impacts. Board roads would also eliminate canal development, but a short (in height) causeway would be built across the Mobile River Delta, impeding flood movement. Constructing the causeway also leaves a linear borrow area, which can become a new drainage channel. A trestle road is open enough that surface water hydrology is not affected.

8.18 In the Mobile River Delta, then, if access to all 19 sites is obtained through the use of trestle roads, there would be very little cumulative impacts on surface waters during normal operations and erosion of wetland spill would be less than if canals

and slips are developed. Wastes would need to be transported along the trestle roads to barges located at the river channel or directly to upland periphery areas.

8.19 The best case condition for the moderate resource scenario is also the same as that for the high resource scenario, except that only 10 sites are developed instead of 19. With trestle road access to the sites there could only be cumulative surface water impacts if different well sites adjacent to each other were accessed simultaneously.

8.20 The best case condition for the low resource scenario is also the same as that for the moderate and high resource scenarios: trestle road access to all sites. As was true with the two higher resource scenarios, there would only be cumulative surface water impact if different well sites adjacent to each other were accessed simultaneously.

Wetland Ecosystems

8.21 Wetland ecosystems in the Delta would be altered by drilling and production activities. The amount of area altered in the future would vary depending on the drilling alternative chosen, the locations of the drilling sites and the length of the pipeline gathering system corridors needed to reach treatment facilities on the adjacent uplands. These factors have been considered in the analysis below.

Determination of Area Affected

8.22 The calculation of wetland area affected by oil and gas activities is based on Figure 8-1. Because the drilling alternative used can make a large difference in the total area disturbed, 3 alternatives were considered to establish the range of area that could be affected for each scenario.

- Canal and slip used with an inland drilling barge. All canals 2,000 feet long by 90 feet wide.
- Platform for drilling rig. Access via 2,000 foot canal by 65 feet wide.
- Platform for drilling rig. One half locations at river bank utilizing directional drilling (if necessary) and one-half located at end of 2,000 foot trestle road.

These alternatives provide reasonable upper and lower limits to area disturbed.

8.23 Pipeline corridor area affected was derived from miles of pipeline laid (Figure 8-1). The dimensions given for the unit action (Chapter 4) were used.

8.23a The area calculated is a worst-case approach since the total area for each scenario represents the cumulative area affected over the 30-year study period if all wells were productive and the well sites and pipeline corridors remained active during the entire period. Restoration of drilling sites that were dry holes or abandonment of exhausted fields before the end of the 30-year period would reduce the total area affected.

8.24 The area of Delta wetlands that could be affected under the 3 resource development scenarios is given in Tables 8-4 and 8-5. Several points can be made about these data:

- Total area affected ranges from 205 acres to 510 acres (0.2 to 0.5 percent of the Delta area).
- Total area affected is not greatly different among scenarios.
- Within each scenario the range in area affected between low and high is as follows:

Scenario	Factor
Low	1.5 times
Moderate	1.8 times
High	2.4 times

- Difference in area affected by drilling alternatives within a scenario is as much as a factor of 10.
- Area affected by drilling sites and access decreases from the high resource scenario to the low resource scenario.
- Area in pipeline corridors decreases from low to high resource scenario.
- Area in pipeline corridors is a significant portion of total area affected in all scenarios.

The greater area in pipeline corridors under the low resource scenario than under the high scenario results from assumptions inherent in the scenario models. For the high and moderate scenarios, oil and gas containing geological structures were assumed to be larger than in the low scenario so that well sites would be linked together with a trunkline to adjacent uplands. Also, cooperation among adjacent operators was assumed so that joint

TABLE 8-4

WETLAND AREA POTENTIALLY AFFECTED BY DRILLING AND PRODUCTION IN THE MOBILE DELTA

Year	High Resource Scenario: New Drilling Sites	High: Drilling Method: Canal and Slip (acres)	High: Drilling Method: Platform and Canal (acres)	High: Drilling Method: Platform and Trestle Road (acres)	High: Pipeline Gathering System (acres)	Moderate Resource Scenario: New Drilling Sites	Moderate: Drilling Method: Canal and Slip (acres)	Moderate: Drilling Method: Platform and Canal (acres)	Moderate: Drilling Method: Platform and Trestle Road (acres)	Moderate: Pipeline Gathering System (acres)	Low Resource Scenario: New Drilling Sites	Low: Drilling Method: Canal and Slip (acres)	Low: Drilling Method: Platform and Canal (acres)	Low: Drilling Method: Platform and Trestle Road (acres)	Low: Pipeline Gathering System (acres)
1	2	34	24	5	0	1	17	12	2.5	37	1	17	12	2.5	0
2	1	17	12	0.5	0	1	17	12	0.5	0	1	17	12	0.5	0
3	2	34	24	3	0	0	0	0	0	0	1	17	12	2.5	0
4	2	34	24	3	0	0	0	0	0	0	0	0	0	0	37
5	1	17	12	2.5	26	1	17	12	2.5	0	1	17	12	0.5	0
6	0	0	0	0	26	1	17	12	0.5	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	1	17	12	0.5	37	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	42	1	17	12	2.5	0
10	2	34	24	3	0	0	0	0	0	0	0	0	0	0	53
11	1	17	12	2.5	0	0	0	0	0	0	1	17	12	0.5	0
12	1	17	12	0.5	0	0	0	0	0	0	1	17	12	2.5	0
13	0	0	0	0	26	1	17	12	2.5	0	1	17	12	0.5	0
14	0	0	0	0	0	1	17	12	0.5	0	0	0	0	0	0
15	3	51	35	5.5	0	2	34	24	3	58	0	0	0	0	0
16	1	17	12	0.5	69	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	1	17	12	2.5	0	1	17	12	2.5	0
18	1	17	12	2.5	0	1	17	12	0.5	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	53	0	0	0	0	0
20	1	17	12	0.5	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal		325	225	30	185		170	120	15	190		155	110	15	255
Total[e,f]	19	510	410	215	NA	10	360	310	205	NA	9	410	365	270	NA

[a]From Figure 8-1.
[b]Assumes that a 2000 foot canal and slip with a drilling barge is used at each drilling location (17 acres per site).
[c]Assumes that a narrow 2000 foot canal and drilling platform is used at each location (12 acres per site).
[d]Assumes that a platform on the river bank is used at half the drilling locations (1/2 acre per site) and a platform at the end of a 2000 foot trestle road is used at the remaining locations (2-1/2 acres per site).
[e]Acre totals rounded to the nearest 5 acres.
[f]Total area affected by drilling method and pipeline gathering system.

NA = Not Applicable.

TABLE 8-5

CONVERSION OF WETLAND AREA IN THE MOBILE DELTA
BY DRILLING AND PRODUCTION ACTIVITIES (ACRES)

Drilling Alternative	Wetland Area Converted to: Open Water	Dredged Material Storage	Cleared Area Under Platforms and Trestle Roads	Pipeline Right-of-Way	Total
HIGH RESOURCE SCENARIO					
Canal and Slip	105	220	NA	185	510
Platform and Canal	75	150	1	185	410
Platform and Trestle Road	NA	NA	30	185	215
MODERATE RESOURCE SCENARIO					
Canal and Slip	55	115	NA	190	360
Platform and Canal	40	80	1	190	310
Platform and Trestle Road	NA	NA	15	190	205
LOW RESOURCE SCENARIO					
Canal and Slip	50	105	NA	256	410
Platform and Canal	35	75	1	255	365
Platform and Trestle Road	NA	NA	15	255	270

NA = Not Applicable.

pipeline systems would be utilized, requiring fewer trunklines to adjacent uplands. In the low resource scenario, smaller more widely spaced geological structures were assumed, reducing the possibility of joint pipelining. Each structure would require a trunkline to uplands.

8.25 The areas given in Table 8-5 have been derived using reasonable assumptions that result in reasonable upper and lower limits on area affected given the alternatives available for necessary activities in the Delta. Certain deviations from these assumptions could modify the areas calculated.

- o No use of directional drilling for wildcat wells assumed for canal and slip drilling method. Assumption of some directional drilling could reduce the area calculated to be altered.

- o Gathering systems could be placed along dredged material storage areas along canals for part of their route. Area calculated for pipeline corridor would be somewhat less.

- o Actual distribution of hydrocarbon resource could determine total area affected. If much of the resource is concentrated in the northern Delta, more area than calculated could be altered because of the need for longer access canals or trestle roads.

Effects of Wetland Alterations on Delta Ecosystems

8.26 Wetland area would be altered several ways by drilling and production activities in the Delta:

- o Converted to open water canals.

- o Storage of dredged material from canals and slips.

- o Cleared under platforms and trestle roads.

- o Maintained free of larger woody vegetation in pipeline corridors.

The amount of wetland area converted to each use would depend on the drilling method or mix of methods employed. In general, area maintained as pipeline corridor is a significant portion of the total area altered for all alternatives. For the platform and trestle road alternative, area in pipeline corridor represents almost all the total altered area. The amount of area converted to open water and dredged material storage area increases as the number

of surface drilling locations increases from low to high resource scenario. Cleared area under platforms and/or trestle roads is small in all scenarios relative to the total area altered.

8.27 Where wetland alterations occurred in the Delta could also be important. The effects of activities in forested wetlands could be different than activities in the treeless southern Delta of emergent vegetation.

8.28 Forested Wetlands. Forested wetlands within the Delta comprise about 100,000 acres. This comprises about 90 percent of total Delta area (Stout et al., 1982). If all wetland alterations in the Delta postulated in the resource development scenario were to occur in forested wetlands, the area affected could vary from about 0.2 to 0.5 percent of the total forested area.

8.29 Alteration of wetland area by oil and gas activities would add incrementally to the alterations that have already occurred in the Delta (Table 8-6). Past activities have altered about 9 percent of the forested Delta area, most by recent logging. Excluding logging, the total area altered is currently about 1.7 percent of the forested Delta.

8.30 The incremental increase in the type of wetland area alteration that could occur under the resource development scenarios would depend mainly on the drilling alternative used (Table 8-7).

Category of Wetland Alteration	Increase Over Existing Altered Area in Category
Converted to open water	4 to 12%
Used for dredged material storage	9 to 27%
Cleared of woody vegetation for right-of-way, platforms and camps only	30 to 43%
Cleared of woody vegetation for right-of-way, platforms, camps, and logging	3 to 4%

Creation of open water and storage of dredged material would occur only when canal and slips or canals and drilling platforms are used for drilling. Clearing of land for pipeline right-of-way would occur regardless of the drilling method used.

TABLE 8-6

CURRENT FORESTED WETLAND AREA ALTERED IN THE MOBILE RIVER DELTA

Disturbance	Open Water Created (acres)	Dredged Material Deposited (acres)	Woody Vegetation Cleared (acres)	Total (acres)
L&N Railroad		149		149
Interstate 65[a]	50	50		100
Power line and pipe-line right-of-way	35	35	621	691
Dredged navigation canals[b]	90	155		245
Power plant fly-ash ponds	642			642
Power plant discharge canal	37			37
Petroleum drilling canals	16	30		46
Subtotal	870	419	621	1910
Recent logging	—	—	7488	7488
Total	870	419	8109	9398

[a]Area in Stout and Dowling (1982), Table 2. Assumed 1/2 open water, 1/2 dredged material storage.

[b]Alabama Power Canal (Stout and Dowling, 1982, Table 2) and Mobile-Tensaw cutoff measured from Map 2, Stout and Dowling (1982). Area for Alabama power canal assumed to be 1/2 open water, 1/2 material storage. Dredged material from Mobile-Tensaw cutoff assumed to occupy 140 acres.

Source: Stout and Dowling, 1982.

8.31 Conversion of forested wetland into open water in canals and slips would result in the complete loss of primary production from these areas and the loss of the areas as habitat for feeding and spawning until restoration was carried out or vegetation maintenance activities ended upon abandonment of the well site or producing field. Adjacent storage of dredged material would also reduce primary production and reduce the habitat value of the area covered. The total cumulative area affected by canals, slips and dredged material storage is as follows (from Table 8-7):

	Canal and Slip Alternative	Platform and Canal Alternative
Low Scenario	155 acres	110 acres
Moderate Scenario	170 acres	120 acres
High Scenario	325 acres	325 acres

8.32 The total area affected would be less than 1 percent of the total forested Delta. Loss of primary production would reduce the quantity of organic matter available as detritus to the Delta aquatic food web and, via export in river water, the food web of Mobile Bay. The natural levee community may be the most productive in the Delta, so that loss of this community type would cause more loss of organic matter per unit area than other community types. Some primary production would be regained slowly from regrowth of vegetation on stored dredged material, but detritus production would probably be reduced for many years.

8.33 Production of organic matter and, therefore, detritus would also be reduced from the area within the gathering system right-of-way. The area affected would be the same within each scenario regardless of the drilling method used:

Low Scenario	255 acres
Moderate Scenario	190 acres
High Scenario	185 acres

Larger woody vegetation would be removed from the right-of-way periodically, maintaining the vegetation in a successional state. Production of litter would occur but in a lesser quantity than for climax vegetation. The right-of-way area would continue to be available as spawning and feeding habitat. The area affected would be less than 1 percent of the total Delta area, but would increase the area maintained as pipeline right-of-way by 30 to 43 percent.

8.34 The area under platforms and trestle roads would very likely have greatly reduced primary production. However, the total area is extremely small compared to the total Delta area. Under this drilling alternative most of the disturbed area would be within pipeline right-of-way.

TABLE 8-7

INCREASE IN FORESTED WETLAND AREA ALTERED BY RESOURCE DEVELOPMENT SCENARIO ACTIVITIES IN THE MOBILE DELTA (ACRES)[a]

Drilling Alternative	Converted to Open Water				Dredged Material Storage				Woody Vegetation Cleared[b]				Total			
	Current Area	Scenario Effect	New Total	Percent Increase Over Current	Current Area	Scenario Effect	New Total	Percent Increase Over Current	Current Area	Scenario Effect	New Total	Percent Increase Over Current	Current Area	Scenario Effect	New Total	Percent Increase Over Current
HIGH RESOURCE SCENARIO																
Canal and Slip	870	105	975	12	419	220	639	53	621	185	806	30	1910	510	2420	27
Platform and Canal	870	75	945	9	419	150	569	36	621	185	806	30	1910	410	3320	21
Platform and Trestle Road	870	0	870	0	419	0	419	0	621	215	836	35	1910	215	2125	11
MODERATE RESOURCE SCENARIO																
Canal and Slip	870	55	925	6	419	115	534	27	621	190	811	31	1910	360	2270	19
Platform and Canal	870	40	910	5	419	19	499	19	621	190	811	31	1910	310	2220	16
Platform and Trestle Road	870	0	870	0	419	0	419	0	621	205	826	33	1910	205	2115	11
LOW RESOURCE SCENARIO																
Canal and Slip	870	50	920	6	419	105	524	25	621	255	876	41	1910	410	2320	21
Platform and canal	870	35	905	4	419	75	494	18	621	255	876	41	1910	365	2275	19
Platform and Trestle Road	870	0	870	0	419	0	419	0	621	270	891	43	1910	270	2180	14

[a]Assumes all activities occur in forested portion of Delta. Increase in total area of Delta affected would be from 0.2 to 0.5 percent.
[b]Excluding logged areas.

8.35 <u>Non-Forested Wetlands</u>. Non-forested wetlands in the Delta formerly occupied about 13,900 acres, almost all in southern Delta. Human activities to date, mostly at the city of Mobile, have resulted in the loss of about 3,300 acres (Table 8-8), leaving 10,589 acres of unaltered non-forested wetlands. The non-forested wetland area already lost is about 24 percent of the original non-forested area and about 3 percent of the current total forested and non-forested wetland area of 110,603 acres in the Delta (Stout et al., 1982).

8.36 Alteration of non-forested Delta wetlands by oil and gas activities would add incrementally to the alterations that have already occurred (Table 8-8). The amount of future alteration would depend on the proportion of the hydrocarbon resource in the Delta that occurs under the southern non-forested portion and on site-specific considerations. An estimate can be made by assuming that the projected area disturbed in the Delta by hydrocarbon activities (see Table 8-5) would be distributed in proportion to the approximately 90 percent - 10 percent distribution of forested and non-forested wetland types in the Delta. Using this assumption, the increase in total area affected under the resource development scenarios is shown in Table 8-9. If this assumption is not correct the area affected could be larger.

8.37 Area converted to open water and used for dredged material storage would be completely lost as wetland habitat until restoration occurred. Based on the above assumptions, the total area would be as follows:

	Canal and Slip Alternative	Platform and Canal Alternative
Low Scenario	15 acres	10 acres
Moderate Scenario	16 acres	12 acres
High Scenario	32 acres	22 acres

This area would be 1 to 3.2 percent of the currently remaining non-forested wetland area based on the assumptions given above. While the area affected may be small compared to the total area of non-forested wetland remaining, the loss would be an addition to the already large loss of area (about 25 percent) that has occurred to date.

8.38 Use of platform and trestle roads for drilling would not require the dredging of canal and slip systems. Vegetation would be eliminated or greatly reduced under the structures, but the area affected would be very small (1 to 3 acres), which is a 90 percent or more reduction in area required for the canal and slip method.

TABLE 8-8

CURRENT ALTERED AREA OF NON-FORESTED WETLANDS IN THE MOBILE DELTA

Disturbance	Type of Disturbance: Open Water Created (acres)	Type of Disturbance: Dredged Material Deposited (acres)	Total (acres)
Interstate 10 work canal	9		9
Dredged material storage		389	389
Industrial and commercial development		2243	2243
Alcoa settling ponds		595	595
Sewage treatment facilities	—	88	88
Total	9	3315	3324

Source: Stout and Dowling, 1982.

TABLE 8-9

EFFECT OF RESOURCE DEVELOPMENT SCENARIO ACTIVITIES ON NON-FORESTED WETLAND AREA ALTERED IN THE MOBILE DELTA (ACRES)[a]

Drilling Alternative	Converted to Open Water				Dredged Material Storage				Under Platforms and Trestle Roads				Temporary Clearing for Installing Pipelines				Total			
	Current Area	Scenario Effect	New Total	Percent Increase	Current Area	Scenario Effect	Plus Scenario	Percent Increase	Current Area	Scenario Effect	Plus Scenario	Percent Increase	Current Area	Scenario Effect	Plus Scenario	Percent Increase	Current Area	Scenario Effect	Plus Scenario	Percent Increase
HIGH RESOURCE SCENARIO																				
Canal and Slip	9	10	19	111	3315	22	3337	0.7	0	0	0	0	0	18	18	NA	3324	50	3374	1.5
Platform and Canal	9	7	16	78	3315	15	3330	0.4	0	1	1	NA	0	18	18	NA	3324	41	3365	1.2
Platform and Trestle Road	9	0	9	0	3315	0	3315	0	0	3	3	NA	0	18	18	NA	3324	21	3345	0.6
MODERATE RESOURCE SCENARIO																				
Canal and Slip	9	5	14	56	3315	11	3326	0.3	0	0	0	0	0	19	19	NA	3324	35	3359	1.1
Platform and Canal	9	4	13	44	3315	8	3323	0.2	0	1	1	NA	0	19	19	NA	3324	32	3356	1.0
Platform and Trestle Road	9	0	9	0	3315	0	3315	0	0	1	1	NA	0	19	19	NA	3324	11	3335	1.3
LOW RESOURCE SCENARIO																				
Canal and Slip	9	5	14	56	3315	0.3	3325	0.3	0	0	0	0	0	25	25	NA	3324	40	3364	1.2
Platform and Canal	9	3	12	33	3315	7	3322	0.2	0	1	1	NA	0	25	25	NA	3324	36	3360	1.1
Platform and Trestle Road	9	0	9	0	3315	0	3315	0	0	1	1	NA	0	25	25	NA	3324	26	3350	0.8

[a]Scenario activity from Table 8-5.
[b]From Table 6-8.
[c]Scenario increment to be added is 10 percent of values in Table 8-5.
[d]Scenario increment to be added is 10 percent of pipeline right-of-way column in Table 8-5.

NA = Not applicable

8.39 The wetland area temporarily disturbed by pipeline construction would be about the same for all drilling alternatives (18 to 25 acres). Primary production and habitat would be lost only during the period of construction. With careful restoration of the right-of-way to its original contours revegetation would occur. No corridor vegetation maintenance would probably be necessary because of the lack of woody vegetation. The effects would be relatively short-term.

Aquatic Ecosystems

8.40 Aquatic ecosystems could be affected by turbidity resulting from dredging activities for canals and slips and for burial of pipelines crossing channels. New aquatic area would be created within canals and slips if used for drilling site access.

Effect of Turbidity from Dredging Activities

8.41 Because only 1 or 2 new drilling sites would be established in any year (see Table 8-4), the probability of concurrent dredging activities occuring in close proximity to each other is low. Therefore, the turbidity resulting from dredging activities in the main channels would probably be localized in the vicinity of the activity. The environmental effects of such turbidity have been described in Chapter 4.

New Habitat in Canals and Slips

8.42 If all sites postulated for the development scenarios in the Delta were developed using canals and slips, the following aquatic area would be created (see Table 8-5):

High Scenario	105 acres
Moderate Scenario	55 acres
Low Scenario	50 acres

These areas would be very small additions to the total of 30,000 acres of aquatic habitat in the Delta.

Groundwater

8.43 Hydrocarbon exploration and development can exert a negative effect on groundwater resources within a region. However, this effect is not easily quantified due to the lack of precise knowledge concerning aquifer characteristics and groundwater flow, as well as pollutant capacity and long term effects of pollutant dispersal and degradation. Pollution potential due to various aspects of exploration and production is also not quantifiable due to the many factors involved. The overall impact to groundwater

resources within the project area will vary depending upon the intensity of petroleum industry activity and the location of this activity with respect to major groundwater aquifers.

Impacts Due to Chloride

8.44 Assumptions will be made with regard to industrial practices, geological characteristics and brine production. It is assumed that common industrial practice will include adherence to zero discharge of pollutants from rigs and strict compliance with state Oil and Gas Board regulations governing all aspects of hydrocarbon development for the protection of groundwater resources. Geologic characteristic assumptions are that underground formations are relatively homogeneous and geologically stable. Brine production volumes vary considerably between wells. Volumes produced may increase with the age of the well, may start high and gradually decrease, or may remain at a relatively constant level throughout, depending upon the geologic configuration of the producing formation and the placement of the perforation zone. For example, wells located in the Gulf of Mexico have reported brine production from one to nine barrels of brine per barrel of oil (Menzie, 1982), and analysis of 1982 data for Mississippi reveals variations from zero to 20 barrels of brine per barrel of oil produced. For purposes of subsequent comparative analysis in this study, a constant brine production value of 2.5 barrels per barrel of oil or condensate will be assumed.

8.45 There is a lack of numerical correlation between various aspects of hydrocarbon development and groundwater pollution. Assessment of the pollution impact of hydrocarbon exploration and development for various levels of resource will be qualitative, based primarily on a subjective assessment of probabilities. A comprehensive discussion of most aspects will be presented for the Mobile River Delta, with only differences highlighted for the subsequent geographical areas.

8.46 The greatest potential impact to groundwater resources will be from chloride contamination, and to a lesser extent, contamination due to hydrocarbons, heavy metals or chemicals. This is primarily due to chloride presence in formation waters and thus in produced brine, in drilling fluids and in other process waters. Chloride is highly soluble in water and the potential for rapid spreading of this contaminant in a water body is great. These impacts may occur to some extent during most activities, including exploration, drilling, well completion, normal well operation, brine disposal and enhanced recovery operations. Accidents such as casing ruptures, well blowouts or spills may contribute greatly to these impacts. However, discussion of such accidents was included in the

unit action analysis and is only addressed here if an increased potential or a cumulative impact will exist for different scenario conditions.

8.47 Exploration activities offer some potential for chloride contamination of shallow aquifers, primarily through shothole drilling. Assuming that these activities will roughly correlate with the number of estimated drilling locations from the projected scenario data, the overall level of exploration activity in this region should be low for all three resource cases. Impacts in the Mobile River Delta, if any, would be localized, affecting the shallow alluvial aquifer, and probably very limited due to expected activity.

8.48 Aquifer contamination during drilling is not a direct function of the number of wells being drilled, nor is it a specifically quantifiable value. However, increased drilling activity would increase the number of opportunities for contamination. The high resource case would have the highest level of drilling activity, up to three or four rigs operating simultaneously. The moderate and low resource cases would generally have two or less active rigs operating at one time.

8.49 Chloride contamination during drilling could occur in both the Alluvial and Miocene-Pliocene aquifers. While the greatest opportunity for contamination would occur between the second and fourth year of the high resource case, based upon drilling activity projections, variance of aquifer pollution opportunities between the three cases would be low.

8.50 Cumulative effects of groundwater pollution from drilling operations could occur, particularly if pollutants enter aquifers undetected. Contamination by formation waters would be the most likely to avoid detection. Additionally, with time a single source of pollutant could disperse and contaminate a large portion of the aquifer, unless dilution and groundwater movement removed the effect. Such cumulative effects, however, could not specifically be estimated for the Mobile River Delta.

8.51 The production phase involves a number of activities which have potential to cause chloride contamination in aquifers. These include completion activities, brine injection and enhancement procedures. During completion activities, fracturing efforts could produce vertical conduits for the movement of formation fluids into upper aquifers. However, production in the Delta region is expected to occur from depths below 15,000 feet. Fracturing in such deep formations would probably not impact on the relatively shallow aquifers used as water resources in the Mobile River Delta regions.

8.52 Brine injection may pose a problem with chloride contamination of aquifers in these regions. Produced brine is generally not injected into the active hydrocarbon formation unless the brine is being used for water flooding as a secondary recovery method. Usually it is injected into a shallower formation that meets the state requirements for Class II disposal. Injection into shallower formations, such as the Wilcox sand at about 4,000 feet in the Mobile River Delta region, may produce a higher potential for natural fractures, faults or other geologic discontinuities such as the Mobile Graben to provide conduits for injected brine movement through the limestone confining beds into the Miocene aquifer. Or passage may occur through the well hole due to faulty cementing or casing ruptures.

8.53 Figure 8-7 presents expected brine production volumes for high, moderate and low resource cases for the Mobile River Delta subregion based upon the assumption of 2.5 barrels of produced water per barrel of oil and condensate expected. The highest probability for aquifer contamination, if it were to occur, is expected to be during periods of maximum brine injection. This maximum would occur in year 14 for the high resource case and years 8 to 14 for the moderate and low resources cases.

8.54 Enhancement procedures may provide potential for chloride contamination of aquifers depending upon the type of enhancement process used. For the Delta region this would most likely occur as a result of casing ruptures. Enhancement procedures, if utilized, would be expected to commence when production begins to fall. For all three resource categories in the Delta, this is estimated to occur after year 14. The probability of pollution due to enhancement procedures would increase after this point. However, quantifying the amount of or actual probability for aquifer contamination is not possible due to the numerous variables involved with procedures and geology.

Metals, Chemicals or Hydrocarbons

8.55 Contamination of freshwater aquifers in the Delta region by heavy metals, chemicals or hydrocarbons may occur during drilling, disposal of drilling muds, enhancement procedures and, to a lesser extent, injection of produced waters. As in the consideration of chloride contamination for this region, the possibilities for heavy metal, chemical or hydrocarbon contamination will increase with drilling and production activities.

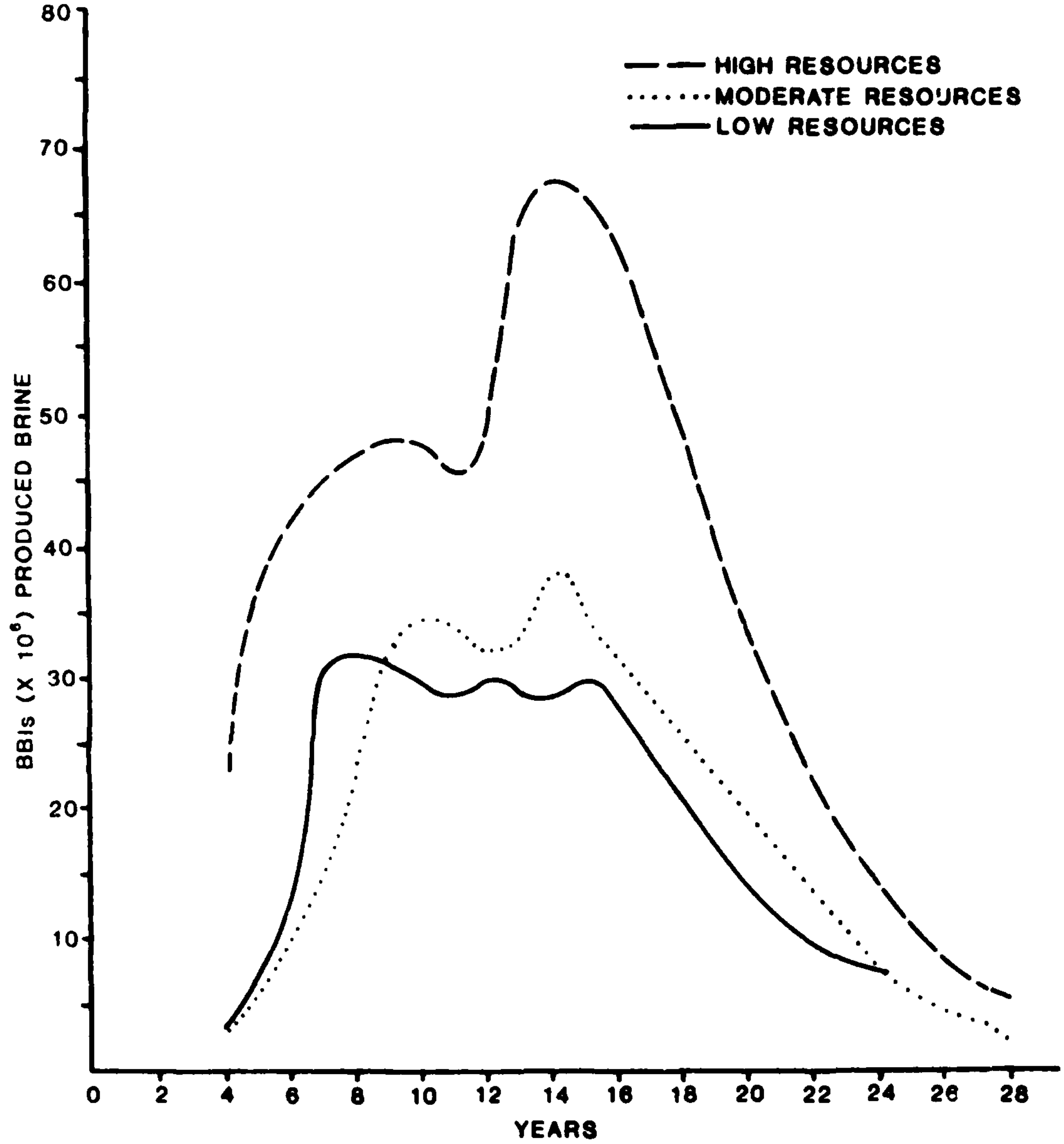


FIGURE 8-7
BRINE PRODUCTION BY RESOURCE CASE FOR THE MOBILE DELTA

8.56 During drilling procedures, contact between fresh water and such pollutants may occur by loss of drilling muds into freshwater formations or into other formations in communication with fresh water. Many different compounds, including petroleum products and various chemicals, may be used in drilling muds, depending upon the geologic situation and function desired. Quantifying the potential for this type of contamination is generally not possible.

8.57 Heavy metal contamination of aquifers has potential for occurrence during the use and disposal of various fluids in the enhancement process. Contact with freshwater aquifers may occur through leakage up the well hole or as a result of casing rupture. The period of highest probability for this occurrence would be after about 14 years for all three resource cases. This time was chosen based upon the assumption that enhancement procedures will be imposed following peak production.

Wastewater Disposal

8.58 Sanitary wastes from well sites, including human body waste and kitchen and cleaning wastes, are transported by barge, boat, or truck to a municipal wastewater collection-treatment system. The total volume of sanitary waste generated in the 30 year planning period due to hydrocarbon development activities in the Mobile River Delta region, including site preparation, drilling and gathering system construction, is projected to be 24 million gallons over a 26-year period. These volumes are minor compared to the amount of sanitary waste generated in the cities and towns surrounding the Mobile River Delta. Properly treated sanitary wastes from hydrocarbon activities should cause no change in surface water quality largely due to the small quantities to be generated. These estimated quantities are for each of the Unit Actions as discussed in the Unit Action Analysis. These estimates are projections for the volume of sanitary wastes generated at the drilling site and the construction site for gathering systems and do not include the additional sanitary wastes transmitted to the Mobile area due to hydrocarbon resource recovery activities. That is, no exclusions have been made for people working at the sites that reside in the Mobile area.

8.59 Types of liquid wastes produced and wastewater management practices are the same under the moderate resource scenario as for the high resource scenario, but quantities will be proportionately less. The total volume of sanitary waste due to hydrocarbon related activities in the Mobile River Delta for the moderate resource scenario is 19 million gallons.

8.60 Types of liquid wastes produced and wastewater management practices under the low resource scenario are the same as for the high and moderate resource scenarios except that waste

quantities will be proportionately lower. The total volume of sanitary waste due to hydrocarbon related activities in the Mobile River Delta for the low-resource scenario is 17 million gallons.

Noise

8.61 The cumulative impacts of noise levels generated by drilling and production activities of the oil and gas industry must be considered in order to obtain a more realistic estimate of noise impact on sensitive receptors. In terms of cumulative effects, oil and gas geo-physical exploration and abandonment activities are assumed to be of relatively low importance (essentially non-issues) in the scenario assessment, although somewhat more seismic and vessel transportation noise would be produced with increased production. The cumulative, as opposed to individual, noise effects of treatment plants are also considered to be of generally lower significance since it is assumed that treatment plants would not be clustered. New treatment plants would, however, likely be larger and more frequent in response to increased production, but would probably be spaced reasonably far apart or located in industrial areas with relatively high existing ambient noise levels. Pipelines would also increase with wellheads, so that the increase in wellheads would likely be greater than the increase in pipelines. However, the possibility of simultaneous construction of pipelines within reasonably close proximity (one mile) will be addressed in this section. The increased onshore pipeline gathering system leading toward a treatment plant could also have a cumulative noise effect since additional pipelines would be constructed and directed to treatment plants, increasing the load per plant. It is assumed that the normal operation of pipelines would not significantly increase ambient noise levels, with the exception of occasional gas venting noise.

8.62 Several drilling rig spacing assumptions are made in order to calculate cumulative noise impacts. It is assumed that offshore drilling rigs will be spaced one mile apart as a minimum so that a maximum of nine active rigs could be sited per oil and gas tract (tracts are approximately three-mile square plots). Based on current specifics/stipulations of Alabama and Mississippi offshore oil and gas leased tract sales (Alabama Department of Conservation and Natural Resources, 1983; Mississippi Department of Natural Resources, 1983b), it is assumed that state setback guidelines/policies will generally restrict offshore drilling rigs to a minimum distance from shore. For Alabama, this general guideline appears to be one mile for "external" water (Gulf of Mexico) shorelines (e.g., southern shore of Dauphin Island) and one-half mile for "internal" water shorelines (e.g., northern shore of Dauphin Island and Mobile Bay shoreline), and for Mississippi it appears to be one mile for "general" ("external" and "internal")

water shorelines. Onshore rigs in the Mobile River Delta will be assumed to be spaced at least one mile apart. These distance assumptions are necessary to calculate noise attenuation distances to shoreline sensitive receptors to help estimate noise impacts.

8.63 It is also assumed that drilling operations will be continuous over a 24-hour period for several weeks and that drilling operations will be the most prominent noise generated relative to the occasional/intermittent noise contributions from supply and crewboats, helicopters, marine signals, and accidents.

8.64 It is furthermore assumed, for the sake of calculation, that noise attenuation will be due to distance under average weather and flat topographic conditions. Calculations will therefore not be corrected for such influencing parameters as wind direction, atmospheric inversions, relief topography, and vegetation although the effects of some of these factors will be cited (e.g., vegetation in the Mobile River Delta). In an EIS study in the Mobile, Alabama area by the U.S. Environmental Protection Agency, Region IV (1978), for example, noise level corrections of 2 dBA or 5 dBA per 100 feet were made to account for "sparse" or "thick" vegetation, respectively, with a maximum of 10 dBA being applied.

8.65 Noise levels used in calculations were obtained from the literature as cumulative values for certain activities (e.g., construction of a gas plant produces an approximate sound level of l_{eq} = 86 dB: U.S. Army Corps of Engineers, 1982a), as measurements of certain activities (e.g., active drilling rig noise measured offshore Louisiana: Coastal Ecosystems Managment Inc., 1974), as noise levels of prominent sources of an activity (e.g., diesel engines for jetting during pipelaying), or as important supportive equipment to activities with "known" (approximate) noise levels (e.g., support vessels operating at a drilling rig site producing approximately 85 dB at 100 feet, which is an estimated value interpreted from Coastal Ecosystems Management, Inc., 1974, that is assumed not to include support vessel noise).

8.66 Calculations for the scenario assessment were assumed to be instantaneous noise level measurements as opposed to statistical or adjusted noise data. For example, sound level descriptors such as L_{eq}, L_{dn}, L_{50}, and the like (see Appendix E), were not calculated and generally not used unless they were presented in the literature. The importance of certain corrections (e.g., L_{dn}, for overnight effects) was mentioned, however, since noise propagation typically increases at night. Literature decibel levels expressed in dB, such as the above drilling rig value (85 dB at 100 ft), were equated with dBA unless another frequency scale was indicated.

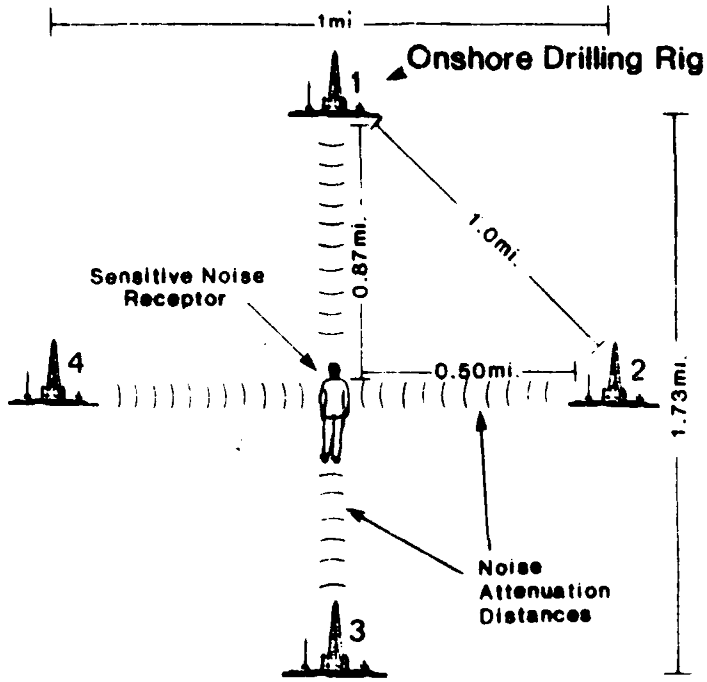
Approach

8.67 Noise levels become important to the hydrocarbon and other industries if they are perceived by sensitive human or wildlife receptors, particularly at levels elevated above ambient. For the present study, examples of sensitive human receptor sites include the residential areas of Dauphin Island, the Fort Morgan peninsula area, Gulf Shores and Fairhope, Alabama, and the Mississippi coast. Sensitive wildlife receptor sites are located in freshwater wetlands (Mobile River Delta area) and saltwater wetlands. Examples of sensitive wildlife receptors include colonial nesting bird sites, waterfowl, and certain aquatic/marine life including marine mammals. The number of active rotary rigs operating in a geographic area per year is critical to the present noise assessment since rigs are considered the primary noise producers in the scenario assessment. The number of rigs will also influence the number of attendant support vessels, equipment, and pipelines. Oil and gas production estimates for the next 30 years in terms of the projected number (range) of active rotary rigs are presented in Table 8-2 by high, moderate, and low resource case postulations. The projection at the low end of the range indicates the "best case" has least impact in terms of noise generation and the upper end of the range would have the greatest impact. Calculations for the scenario assessment are based on three equations described in Appendix E.

8.68 The rationale upon which several noise level calculation estimates were based for the onshore (Mobile River Delta) area are depicted in Figure 8-8. Projections in Figure 8-1 indicate that at a maximum four rigs based be active under the high resource case and two active rigs would occur under the moderate and low resource cases at any one time in the Mobile Delta.

8.69 The configuration of the sensitive receptor relative to the drilling rigs (1 to 4 rigs) is important in maximum noise level estimations. Figure 8-8 depicts the assumed maximum configuration for a central sensitive receptor and four drilling rigs, assuming that rigs will be a minimum of one mile apart and receptors no closer than one-half mile apart. As indicated by the figure, the sensitive receptor is one-half mile from two rigs (Rig 2 and 4) and 0.87 (0.866) mile from the other two rigs (Rig 1 and 3). This arrangement allows all rigs to be a minimum of one mile (1.0 to 1.73 miles) apart (Rig 2 from 4, 1 from 3, 3 from 4, 3 from 2, 1 from 4, and 1 from 2). An alternate configuration would have been an equidistant placement of the receptor 0.707 mile from each of the four rigs. However, this does not yield the maximum case in terms of noise since the cumulative noise level would be approximately 3 dBA less at the receptor site when compared to the first configuration. This is due to the two relatively close (0.5 mile) noise attenuation distances.

ONSHORE DEPICTION



MOBILE RIVER DELTA

FIGURE 8-8
WORST CASE RESOURCE PROJECTION FOR FOUR ONSHORE ACTIVE DRILLING RIGS THAT ARE A MINIMUM OF ONE MILE APART AND EQUIDISTANTLY CLUSTERED A MINIMUM DISTANCE OF 0.5 MILE AROUND A SENSITIVE NOISE RECEPTOR

8.70 The presence of three drilling rigs can also be illustrated by Figure 8-8, again assuming a one-mile distance minimum between all rigs and a minimum of one-half mile between the receptor and any rig. The two closest rigs (Rig 2 and 4) would be appropriate and one of the other two rigs (Rig 1 or 3) would be added as arranged in the figure.

8.71 The maximum instance for two rigs as illustrated by Rig 2 and 4 in the figure, assumes a one-mile minimum between rigs and a one-half mile minimum between a rig and the receptor. The presence of one rig is represented by either Rig 2 or 4 and assumes that the sensitive receptor is not closer than one-half mile from the rig.

Canal Access Construction

8.72 Maximum Noise Under the Scenario. Construction dredging of canals for inland drilling barge access would produce noise principally emanating from a mechanical dredge (dragline) and tug boat. The U.S. Environmental Protection Agency, Region IV (1978) estimated in a draft EIS that a noise level of 85 dBA at 100 feet would emanate from a hydraulic dredge, pump, and tug boat used for the "improvement and extension" of the Theodore Ship Channel in the Mobile area. Using this figure as a guide for the dragline and tug boat that would presumably be used in canal access dredging in the present study, and assuming four canals were dredged simultaneously for four inland drilling barge wells in a worst case (high resource) scenario for the Mobile River Delta, an approximate cumulative noise figure can be calculated for the noise receptor depicted in Figure 8-8. Since the end canal sites are 1.0 mile apart for two rig sites (2 and 4) and 1.73 miles apart for the other two rig sites (1 and 3), the receptor would be 0.5 mile from two sites and 0.87 mile from the other two sites. Using Equation 1, (Appendix E) the noise level would attenuate from 85 dBA to 54 dBA for each dredging operation, 0.5 mile from the receptor and from 85 to 46 dBA for each dredging operation 0.87 mile from the receptor. Using Equation 2, the cumulative effect for all four noise emissions would be 58 dBA for the sensitive receptor. Since mechanical dredges are presumably noisier than hydraulic dredges, an estimate higher than 85 dBA (90 dBA) was also used in the calculations. The 90 dBA would attenuate to 59 dBA over the 0.5 mile distance, and to 51 dBA over the 0.87 mile distance. The cumulative noise level for the four dredging operations would be 63 dBA. These dredging noise estimates are summarized in Table 8-10.

TABLE 8-10

APPROXIMATE DRILLING RIG CONSTRUCTION AND NORMAL OPERATION NOISE LEVELS ATTENUATED OVER DISTANCE FOR THE MOBILE RIVER DELTA

Number of rigs	Attenuated cumulative noise levels (dBA)*			
	Construction			Normal operation
	Dredging (85 dBA)**	Dredging (90 dBA)**	Pile driving (101 dBA)***	Drilling (85 dBA)**
1	54	59	64	54
2	57	62	67	57
3	58	63	68	58
4	58	63	68	58

*Also see Figure 8-8 and text.
**Operation noise level at 100 ft.
***Operation noise level at 50 feet (=95 dBA at 100 feet).

8.73 During projection years where only three dredging operations are present, the cumulative noise effect would be 58 dBA for the 85 dBA dredge noise estimate. The 90 dBA estimate would contribute a cumulative 63 dBA for the three dredging operations. Such decibel levels can be compared to Chapter 3 discussion of ambient levels for a noisy urban setting (66 Ldn) or to measured levels for Dauphin Island Gulf surf (55-65 dBA). The characteristics of rig noises are more closely compared to the urban example. There is a difference between naturally occurring and introduced noise at the same decibel level.

8.74 Maximum Noise Under the Moderate Resource Scenario. As indicated in the resource projections, a maximum of two drilling rigs are expected under the moderate resource scenario. Using the 85 dBA estimate and the above attenuation to 54 dBA for the two closest rigs (0.5 miles from the receptor), the cumulative effect of the two canal dredging operations would be 57 dBA. Using the 90 dBA alternative estimate and attenuation to 59 dBA, the cumulative effect of two dredging operations would equal 62 dBA (Table 8-10).

8.75 Maximum Noise Under the Low Resource Scenario. The most noise according to the low resource scenario for the Mobile River Delta subregion is the same as that for the moderate scenario since a maximum of two rigs (canals) are postulated.

8.76 Minimum Noise Under All Resource Scenario. Because information under the resource scenarios indicates that some years are projected to have no active rigs, zero dredging noise effect is appropriate for the best case for all three resource projections.

Drilling Rig Installation

8.77 Maximum Noise Under the High Resource Scenario. A major noise source for inland drilling barge positioning and stabilizing is generated from pile driving activities (101 dBA at 50 ft). Using 101 dBA at 50 feet in Equation 1 (Appendix E), the noise level at the drilling site would attenuate to 64 dBA over the 0.5 mile distance and to 56 dBA over the 0.87 mile distance. The cumulative noise level for the high range of the scenario with four drilling rig sites would be 68 dBA for the sensitive receptor (Table 8-10). During years with pile driving activities at only three drilling rig sites, the cumulative noise effect would be 68 dBA for the receptor.

8.78 Maximum Noise Under the Moderate Resource Scenario. Based on a maximum of two drilling rigs for the moderate resource scenario the cumulative noise level for two pile driving activities attenuated to 64 dBA would be 67 dBA for the receptor.

8.79 Maximum Noise Under the Low Resource Scenario. Since the number of rigs under the low resource scenario is also two, the cumulative noise impact would be the same as that described above for the moderate case (67 dBA).

8.80 Minimum Noise Under All Resource Scenarios. The best case for Delta drilling rig construction is no rig construction and zero noise impact.

Normal Operation of Drilling Rigs

8.81 Drilling rig noise was considered in the Unit Action. Inland barges, fixed platforms, jack-ups, and submersibles were assumed to be similar in terms of noise (land rigs may be slightly noisier due to engine fan noise). A generic rig was therefore assumed to be similar to noise levels presented in Chapter 5. Graphical interpretation suggests that such a rig would emanate approximately 85 decibels at 100 feet. It was assumed that "decibels" were in dBA. This estimate was used in generic rig noise calculations.

8.82 Maximum Noise Under the High Resource Scenario. The projections under the high resource case is four active drilling rigs. If sited as depicted in Figure 8-8 and if emitting the assumed 85 dBA, each rig would produce 54 dBA at the receptor 0.5 mile away and 46 dBA at the receptor 0.87 mile away under normal conditions. The cumulative effect of four rigs would be 58 dBA. The presence of three rigs including the two closest, (e.g., Rigs 2, 4 and 3) would result in a cumulative value of 58 dBA.

8.83 Maximum Noise Under the Moderate Resource Scenario. Two rigs are projected at a maximum for the moderate resource case. Assuming the same attenuated noise level of 54 dBA, the cumulative noise level at the receptor for the two closest rigs (0.5 mile) to the receptor would be 57 dBA.

8.84 Maximum Noise Under Low Resource Scenario. Two rigs at most would result under the low resource scenario. The cumulative noise effect of 57 dBA would therefore be the same as for the moderate resource projection.

8.85 Minimum Noise Under All Resource Scenarios. Based on the resource projections no active rigs will be present during certain periods over the next 30 years. Therefore, at a minimum, there would be no rigs and no noise effect.

8.86 The presence of one active rig would produce 54 dB at the receptor site, so that the cumulative noise effect for the

normal operation of one rig (0.5 mile away) to four rigs ranges from 54 to 58 dB.

Pipeline Construction

8.87 Noise estimates for onshore pipeline construction are expressed in the Unit Action. It is assumed that trenching on dry land would produce noise levels similar to dredging in wetland Mobile River Delta areas. It is also assumed that blasting is intermittent and not always necessary. Disregarding blasting noise, therefore, activities presented in the Unit Action show a cumulative value of 93 dBA (although probably not all activities would occur simultaneously) at the edge of the right-of-way. These levels are somewhat similar to land pipelaying noise data (L_{eq}) also presented in the Unit Action (L_{eq} of 86 dB at 100 ft) provided by the U.S. Army Corps of Engineers, (1982a). The L_{eq} of 86 dB at 100 feet value was chosen for calculations because it is in the literature and is expressed as a cumulative (L_{eq}) level for pipelaying operations and is assumed to be similar to wetland pipelaying noise levels.

8.88 Maximum Noise. Because it is assumed that a single pipeline can serve several clustered or non-clustered wellheads, an increase in wellhead number will result in a disproportionately smaller increase in the number of pipelines. However, at a maximum the simultaneous construction of two pipelines could occur at one mile apart. Using the L_{eq} of 86 dB at 100 feet figure, the noise level for a receptor equidistant (one-half mile) from each source would be 55 dB. The cumulative effect of the two equal sources would be 58 dB.

8.89 The maximum value could be increased for an equidistant receptor as the pipelines merge toward a treatment plant facility until pipeline construction would essentially be joined at the same site (no attenuation distance). The construction of two merged pipelines would produce a cumulative noise of L_{eq} = 89 dB. Should three pipelines merge, 91 dB would be produced, and four pipelines would together emit 92 dB.

8.90 Minimum Noise. At a minimum there would be no construction of additional pipelines and continued use of existing systems. An intermediate case would be the construction of some new pipelines that are spatially separated by great attentuation distances until they merge near a treatment plant. As indicated above, construction of a single pipeline may generate an L_{eq} of 86 dB at 100 feet. The effect of this noise level on a receptor would depend on the attenuation distance, with noise generally attenuating 6 dB with every doubling of distance (WAPORA, 1981). The 86 dB at

100 feet would attentuate to 55 dB over a one-half mile distance and to 44 dB over a mile distance.

Threatened and Endangered Species

8.90a Threatened and endangered species in the Mobile Delta could be affected by the disturbance of habitat or spills of hydrocarbon liquids. Routine exploration and production operations would result in some wetland habitat alternation. Overall, only a small amount of habitat is estimated to be altered in the Delta by routine operations. The overall effect of these activities on threatened and endangered populations of the Delta is likely to be minor. However, any individual action could have a significant effect depending on he site-specific characteristics of the location of the proposed action.

8.90b The effect of a spill of hydrocarbon liquids would depend on the size of the spill and the particular circumstances at the time of the spill that would determine how large an area the spill affected. A large uncontained spill that affected a large area could have significant effects on Delta populations from direct mortality or indirect long-term effects from residual material retained in wetland and river channel soils and sediments. Such a spill has a low probability of occurrence.

8.90c A smaller spill would have a localized effect in the vicinity of the affected area. The significance of such a spill on threatened or endangered species would depend on the site-specific circumstances at the location of the spill.

Commercial Fisheries

8.91 Commercial fishing is not concentrated in a single area of the Delta and because of the relatively small number of daily boat trips and the number and geographic spread of access points (public and private launching ramps), it is not likely that waterway traffic associated with postulated oil and gas development would affect area commercial fisheries. Under the high development scenario, it is estimated that the increase in total boat traffic could amount to a high of approximately 40 vessels per day (see Navigation section). However, most of these would be crew boats travelling between a rig and a nearby landing used as a crew trasfer point and such boats would generally be on the water for less than one-half hour. It is not expected that this traffic increase would significantly affect commercial fisheries in the Delta.

8.92 In certain gathering line cases where hydraulic dredging in a small channel uses a floating discharge pipe extending across the whole channel, such a waterway would be closed to other boat traffic including commercial fishing boats for the few days the channel is closed. However, due to the very low level of commercial fishing activity, the wide geographic distribution of boat landings, the vast number of waterway miles that could be fished, and the small number of cases where a waterway would be completely closed, it is not expected that boats involved in fishing activities would often encounter such a waterway obstruction.

Navigation

8.93 The principal potential impact to area navigation from the various postulated levels of oil and gas development for the study region would be the increased waterway traffic associated with this development. Based on the data from the resource development scenarios for the Mobile River Delta (Figure 8-1), and on the assumptions described in Appendix F, the potential daily maximums of waterway traffic increase were calculated for the projected hydrocarbon development activities in the Delta (Table 8-11). Although exact drilling locations cannot be projected, it is expected that these potential traffic increases would be distributed over the various navigable channels in the Delta. The waste and supply barge traffic would travel the length of the Delta (from a particular drilling location) into the Mobile area or through Mobile Bay and beyond. The crewboat traffic, however, would travel a much shorter distance to a nearby landing used as a crew transfer point.

Cultural Resources

8.94 For oil and gas development activities in the Delta, a consideration of cultural resources is required by the Mobile District in order to identify potentially significant resources prior to any project activities. Following a literature and records search, a field reconnaissance may be performed in the project area dependent on the findings of the records search and comments of the appropriate State Historic Preservation Officer or other knowledgeable individuals.

8.95 If evidence of cultural resources is found during the survey, an intensive field survey would be performed to delineate the extent of the remains in relation to those areas that could be disturbed by proposed project activities. Prior to the issuing of any permit, any conflicts regarding the potential impacts to cultural resources due to project activities must be resolved.

TABLE 8-11

POTENTIAL DAILY MAXIMUMS OF WATERWAY TRAFFIC INCREASE
IN MOBILE RIVER DELTA

Phase	High Scenario[a]		Moderate Scenario[b]		Low Scenario[a]	
	Barge Trips	Crew Boat Trips	Barge Trips	Crew Boat Trips	Barge Trips	Crew Boat Trips
Drilling						
Site Preparation	1	1	0	0	1	1
Routine Operations	3	12	2	8	1	4
Production						
Well Completion	2	12	2	12	1	6
Normal Operations	0	6	0	4	0	3
Other Traffic	—	—	—	—	—	—
Delta Traffic	6	31	4	24	3	14

[a]Scenario Year 5
[b]Scenario Year 4

Spills and Loss of Well Control

8.96 Accidents are evaluated in this study as single, independent events. Multiple simultaneous accidents are not addressed except to say that impacts could overlap based on anticipated distances which spills can travel.

8.97 Accidents are more likely to occur under the high resource scenario than under the low resource scenario. As more equipment is utilized, more labor is expended, more chemicals and drilling fluids are utilized, and more hydrocarbons and formation waters are extracted, the probability that an accident would occur increases. In years since the early 1970's the probability of accidents at well sites has steadily decreased in open Gulf waters. However, probabilities for barge accidents have not been shown to decline, and accident probabilities in wetland areas are not known to have been thoroughly documented. Therefore, no quantitative estimates of accidental spills can be presented for the various scenarios projecting hydrocarbon development in the Mobile River Delta other than to say that the probability of losing well control is generally the same (one in 250; see Paragraph 4.314) in all types of environments. The high, moderate, and low resource scenarios seem to indicate that within each scenario no significant variations in hydrocarbon resource extracted per well are evident as the number of wells increase. Therefore, as the number of wells, quantities of chemicals, hours of labor and quantities of extracted resources increase, the probable number of accidents at wells, pipelines or barges would increase at approximately the same rate. The probable quantities of spilled materials may also increase if larger pipelines and larger barges are utilized. In the same manner, quantities of extracted resources or wastes spilled per accident at a processing facility or at a waste treatment/disposal site could increase as more hydrocarbons are extracted. Such increases in quantities spilled per accident could be particularly high from years of peak production (Years 14 to 20) under the high resource scenario. Spills from pipelines which transport hydrocarbons from more than one well could be larger than spills from pipelines which transport hydrocarbons from a single well, because the pipelines transporting hydrocarbons from multiple wells have larger diameters and they may transport hydrocarbons at higher velocities or higher pressures.

Accidental Release of Natural Gas Containing Hydrogen Sulfide

8.98 The probability of an accidental release of natural gas from pipelines was calculated using a modified pipeline leak detection model (Appendix E). Based on the average annual per-mile incident probability derived from the model and on the system

mileages for the various scenarios (Figure 8-1), the incident frequency (in terms of the number of years for such an incident to occur) for pipeline release in the Delta would be:

Scenario	Mileage	Frequency
High	35	20.7 years
Moderate	36	20.1 years
Low	41	17.7 years

As used in the model, an incident is any pipeline release, from the smallest possible leak to a pipeline rupture

ENVIRONMENTAL CONSEQUENCES IN MOBILE BAY

8.99 Potential effects associated with the hydrocarbon resource development scenarios on the biological and physical environment of Mobile Bay are discussed in this section.

Water Quality and Hydrology

Worst Case

8.100 In Mobile Bay and Mississippi Sound, cumulative impacts can result from dredging access channels to drilling sites located in shallow waters. For the barges and crew boats used in hydrocarbon development, a minimum channel depth of seven feet is needed. The worst case condition, then, is having the maximum number of drilling sites in waters less than seven feet deep. Presumably, drilling companies will avoid unnecessary dredging activities. It is estimated that only three drilling sites would be in shallow waters requiring the dredging of access channels.

8.101 The actual dredging of each of the access channels, regardless of the dredging method utilized, will result in a turbidity plume and perhaps minor releases of other pollutants, but these effects are not cumulative unless adjacent sites are dredged simultaneously. Moreover, the amount of dredging for hydrocarbon activity is small compared to the volumes of material dredged for navigation channel maintenance. If the material dredged from channels averages 3.5 feet deep, 65 feet wide at the bottom, and 2,000 feet long, and if the channels have a side slope of 1:5, the total volume dredged will be 21,400 cubic yards. This compares to an average dredging volume greater than 13,700,000 cubic yards for annual channel maintenance in Mobile Bay and Mississippi Sound (U.S. Army Corps of Engineers, 1979), and this volume is likely to increase substantially if deeper channels are authorized for Mobile or other harbors.

8.102 The long-term, cumulative impacts of dredging access channels will occur from the presence of a few shallow depressions in the Mobile Bay and Mississippi Sound bottoms. Previous dredging activities have definitely affected Mobile Bay. It is well documented that the navigation channels in Mobile Bay have altered the salinity regime of the Bay by allowing a salt wedge from the Gulf of Mexico to move up into the Bay, and even into Mobile River (Schroeder, 1979 and Loyacano and Smith, 1980). The effects of the channels on water circulation are not as well understood, but it has been argued that the spoil piles on the sides of the channels have blocked exchanges between the eastern and western sides of Mobile Bay. Oyster shell mining has left depressions where bottom waters reportedly stagnate and become low in dissolved oxygen.

8.103 The impacts of the access channels would not be expected to be as severe as those of the harbor and bay navigation channels, or even the mining or borrow depressions, for several reasons. Physically, the access channels are much shallower (7 feet deep instead of 40, and hundreds or a few thousand feet long instead of tens of miles) so they are far less likely to cause noticeable impacts, particularly on a cumulative, Mobile Bay/Mississippi Sound-wide scale. Access channels start and end in the same body of water, unlike navigation channels that may run from fresh river water to Gulf seawater, and the access channels will not connect to the navigation channels, so the salt wedge will not move into them unless it has spilled out of the channels and is moving across the entire bottom. The access channels are in shallow water that is usually well mixed by winds and tides and they will not be hydrologically isolated pockets like the mining or borrow areas, because one end where the bottom naturally reaches a depth of seven feet will have the same bottom elevation as the surrounding open bottom. With this open connection and natural vertical mixing in shallow waters, the formation of stagnant bottom waters with low dissolved oxygen is less likely. The U.S. Environmental Protection Agency, Region IV favors open-water disposal of dredged material in the Gulf of Mexico when upland disposal has been ruled out, so there may not be spoil banks lining the access channels and hindering circulation (letter published in U.S. Army Corps of Engineers, 1980).

8.104 It may be possible to test for effects of a few access channels on the hydrology or water quality of Mobile Bay on Mississippi Sound with a model, either the physical model of Mobile Bay located in Vicksburg (which the Corps considers to be too expensive to operate) or the mathematical model developed for the Mississippi Sound study, although the proposed physical changes in bathymetry depending upon their specific locations may be too small to enter into the models.

8.105 If pipeline construction were to consist of trenching with no backfill, then the effects of pipeline construction on water quality could be more significant than the effects of the access channels. The pipelines that would pass from the Federal waters of the Gulf to the land would have the greatest potential for impact, because long, narrow trenches could do what the navigation channels do, i.e., provide routes for saltwater from the Gulf to move up into Mobile Bay or Mississippi Sound. It cannot be stated with certainty, however, that this impact would occur. In any event, the regulations of both Alabama and Mississippi require backfilling trenches after construction, so although there would be impacts during construction and testing, there would be no long-term cumulative turbidity impacts, assuming proper backfilling is accomplished, even though backfilling could result in short-term turbidity impacts.

8.106 The worst case condition for the moderate resource scenario is the same as that for the high resource scenario, except that only two drilling locations in waters less than seven feet deep are estimated to be required. The possible impacts from access channels are likely to be less adverse with only two channels instead of three.

8.107 It is estimated that under the low resource scenario there would be no sites drilled in waters less than seven feet deep. There are, therefore, no cumulative impacts to surface waters for this level of development.

Best Case

8.108 The possibility of impacts cumulating under normal operations can be eliminated by not dredging any channels and by backfilling all trenches to original contours. Obviously, the absence of dredging channels can only happen if all drilling locations are in water deep enough to provide barge and service boat access. The best case condition is all drilling locations in waters more than seven feet deep and all pipeline trenches backfilled to original contours. Under this cordition, these would be no cumulative impact to surface waters under normal operations without spills, accidents or intentional waste discharges.

8.109 The best case condition for the moderate resource scenario is also the same as that for the high resource scenario: no access channels. There would then be no cumulative surface water impacts in the best case condition under normal operations.

8.110 The best case condition for the low-resource scenario, like that for the high and moderate resource scenarios, is no access channels. There would also be no cumulative surface water impacts in the best case condition under normal operations.

Wetland Ecosystems

8.111 All wetland area bordering Mobile Bay could be reached by directional drilling. No effect on wetlands would result from drilling if this method was used. Adequate area probably also exists for pipeline landfalls without crossing wetlands. Should a landfall be necessary between Weeks Bay and the Bon Secour River, however, forested wetland would be crossed for about 1 mile. Assuming a 75-foot right-of-way is necessary for a larger diameter pipe system, then about 10 acres would be required for a corridor. It is not likely that more than 3 corridors would be needed. Reduced primary production on 30 acres of the approximately 3,200 acres of forested wetland in the vicinity would not be a significant change if no other alterations from other activities occur within the wetland.

Aquatic Ecosystem

8.112 The aquatic ecosystem of Mobile Bay would be affected mainly by turbidity and benthic organism destruction resulting from drilling site preparation and operation and pipeline construction. The ecological significance of these disturbances would depend on the timing and magnitude of the operations occurring at any time.

Determination of Benthic Area Affected

8.113 The area of benthic habitat disturbed yearly by drilling sites and pipeline construction has been calculated from drilling and production sites and miles of pipeline within Mobile Bay (Figure 8-2) and from miles of pipeline crossing state waters from the adjacent federal waters (Figure 8-6). Areas calculated in Chapter 5 for the unit actions were used to obtain total area affected by year (Figure 8-9). Because the area affected by drilling sites would be small compared to area affected by pipeline construction, only pipeline area has been plotted in Figure 8-9. The proportion of pipeline miles from the federal waters (Figure 8-6) that would traverse Mobile Bay was estimated by assuming that 60 percent of the volume of hydrocarbon from federal waters would come onshore through Mobile Bay, mainly in large diameter trunk lines.

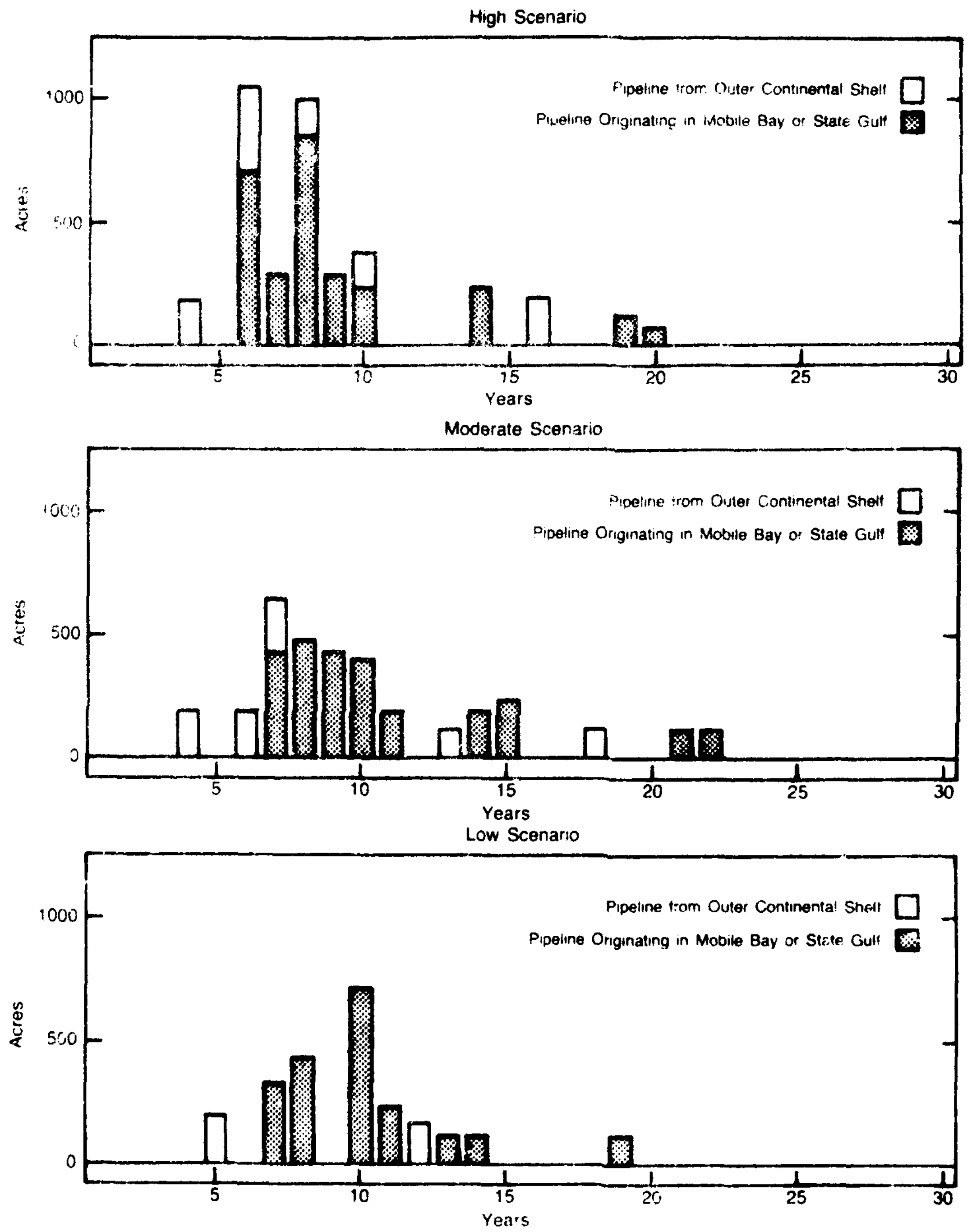


FIGURE 8-9
AREA REQUIRED FOR PIPELINE CORRIDORS IN MOBILE BAY FOR THE RESOURCE DEVELOPMENT SCENARIOS

Effects on Aquatic Ecosystems

8.114 Area disturbed by drilling sites would be small compared to pipeline emplacement activity. Other production and abandonment activities would have only minor effects at the well sites.

8.115 Drilling Sites. The maximum benthic area directly affected by drilling sites for an inland drilling barge would be about 30 acres if no dredging is required for access. This total includes about 15 acres directly buried by the shell pad and about 15 acres affected frequently by propwash of service vessels. The one-half mile drilling exclusion zone around the shoreline would put drilling sites in water depths of 6 feet or greater in all parts of the bay except the northern area near the Battleship Causeway. Dredging for site access would probably not be required except in this northern area.

8.116 The temporary alteration of 30 acres of benthic habitat within Mobile Bay over a 30 year period should have a very small effect on the bay ecosystem, although this would be an incremental addition to other ongoing large-scale benthic disturbances such as dredging of shell deposits and channels.

8.117 If drilling sites are established in shallow waters less than 6 feet deep near the Battleship Causeway, dredging of channels and slips would be required for site access. A maximum of 3 sites would allow drilling to reach almost all of this area. Assuming a 1500 foot channel (4.5 acres, see Chapter 5) and a 5 acre slip for a drilling barge, about 9 to 10 acres would be disturbed per drilling site, 30 acres if 3 sites are used. This area could be reduced by about one-half if a drilling platform was used instead of a slip (see Chapter 4). While 30 acres is not a large area compared to the approximately 9500 acres of shallow water area, much of the area is covered with submersed aquatic vegetation and is important feeding habitat for overwintering waterfowl. The significance of effects of drilling activities on this area are uncertain but could be of concern.

8.118 Pipelines. Emplacement of pipelines within Mobile Bay could temporarily affect large areas of benthic habitat (Figure 8-9) and create turbidity over a long period of time. For the high scenario the disturbances occur mainly in years 6 through 10. For the moderate scenario disturbances would occur over a longer time. For the low scenarios almost all disturbances would occur from year 7 through 14.

8.119 Total benthic area disturbed at one time would be greatest under the high scenario. In years 8 and 9 as much as 2300 to 2500 acres of bay bottom could be either newly disturbed or in various stages of recovery of populations of benthic organisms (sum of area disturbed in years 6 through 9). This is almost 1 percent of the approximately 264,000 acres of benthic habitat in Mobile Bay. Added to this would be area affected by maintenance dredging of navigation channels and shell dredging that might occur in those years.

8.120 The effect of the loss or reduction for several years of the secondary production of benthic organisms from about 1 to 1.5 percent of Mobile Bay would depend on the distribution of the disturbances and the types of benthic communities affected. For example, pipeline emplacement in the shallow area of the northern bay would temporarily affect a particularly valuable habitat for waterfowl. In general, however, a disturbance of the magnitude calculated may fall within the annual variation in secondary production that occurs naturally from year to year in Mobile Bay. Maximum benthic area affected under the moderate and low scenarios would be only one-half to one-third that of the high scenario.

8.121 The cumulative effect of turbidity from trenching and backfilling operations are also difficult to determine because the effect may be a function of the number of operations occuring at one time, the proximity of the operations to each other and the particular resources near the operation. Under the high scenario possibly as many as 4 operations may be occurring at one time during years 6 through 10. If these are widely separated the effects would local to the area of operation as described in Chapter 5. If the operations are near each other it is possible that turbidity plumes could come together. For the moderate and low scenarios, it is likely that no more than one or two trenching or backfilling operations would be occurring at any time.

Groundwater

Impacts Due To Chloride

8.122 Based upon the discussion presented previously for the Delta and the assumption that chloride contamination during drilling could be related to drilling activity, the possibility for such contamination in Mobile Bay is considerably greater than for the Mobile River Delta. The high resource case would have only a slightly greater activity level than the moderate and low cases. Overall potential for chloride contamination due to drilling would be greatest for the high resource case, and years 7 to 10 would offer the most possibilities based upon expected drilling activity levels.

8.123 Cumulative effects could occur by the same process as discussed for the Delta, except the much higher level of drilling activity for all resource cases within the Mobile Bay area would provide a greater opportunity for cumulative contamination to occur. Additionally, the areas surrounding Mobile Bay, such as the Dauphin Island and Gulf Shores regions, are already experiencing problems with contamination of the shallow aquifers, both by saltwater encroachment and septic tank discharge. Any additional chloride contamination from hydrocarbon exploration and production would serve to exacerbate the situation.

8.124 Figure 8-10 presents the expected brine production volumes for hydrocarbon production in Mobile Bay, based upon the previously discussed estimate of 2.5 barrels produced water per barrel of oil and condensate. The Mobile Bay subregion is expected to yield mainly condensate and gas, with very little oil. As can be noted, years 10 to 12 for the high resource case will have the highest level of brine production and hence the most possibilities for chloride contamination due to brine handling and disposal. For all three resource cases, years 10 to 20 exhibit the highest periods of brine production and would be of most concern. However, brine produced from the Mobile Bay area may actually be disposed of onshore within another geographical section. The major potential for chloride contamination within Mobile Bay therefore would occur as a result of drilling or casing ruptures during production or enhancement operations.

Impacts Due to Heavy Metals, Chemicals or Hydrocarbons

8.125 The Mobile Bay subregion would have a higher probability for heavy metal or chemical contamination than the Delta because a greatly increased level of drilling would provide more opportunities for drilling mud loss to formations and contact with groundwater. Drilling muds in this area would generally not be oil based. Hydrocarbon pollution, if any, would only be expected by communication with freshwater aquifers through the well bore. Impacts due to drilling mud disposal would be as previously discussed for chloride contamination.moderate and low cases.

8.126 Depending upon the type of enhancement process selected, some potential for heavy metal, chemical or hydrocarbon contamination may exist. Assuming that this probability increases with increasing enhancement activity, this would be expected after year 14 for the high resource case and after year 20 for the

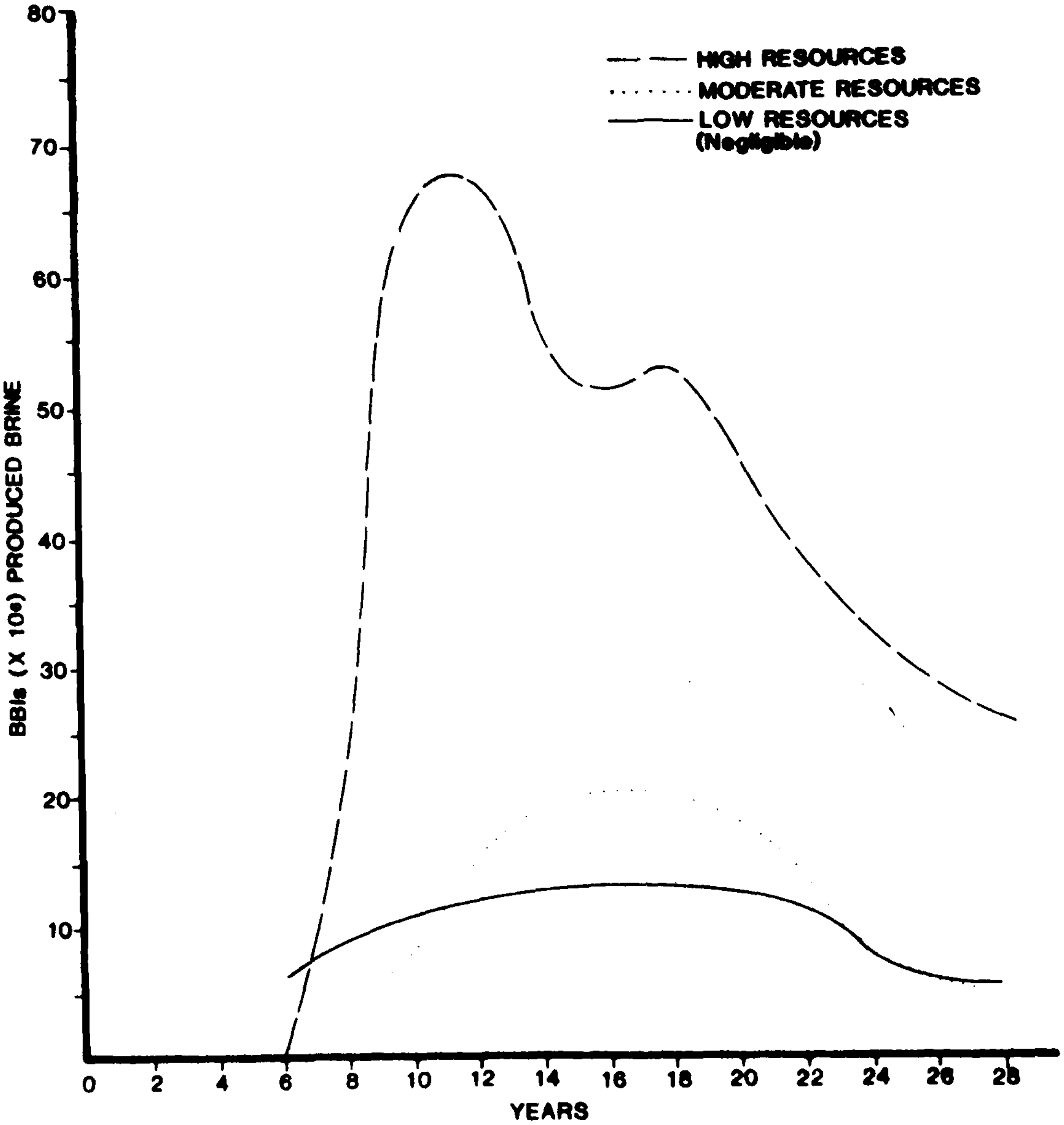


FIGURE 8-10
BRINE PRODUCTION BY RESOURCE CASE FOR MOBILE BAY

Wastewater Disposal

8.127 The total volume of sanitary waste produced in Mobile Bay and Mississippi Sound for the high resource scenario is 220 million gallons over a 24-year period.

8.128 Types of liquid waste produced and wastewater management practices are the same as for the high resource scenario; quantities will be proportionately less. The total volume of sanitary waste due to hydrocarbon related activities in Mobile Bay and Mississippi Sound for the moderate resource scenario is 290 million gallons. Quantities are higher for the moderate resource scenario than for the low resource scenario primarily because more time is taken to extract resources under the moderate resource scenario.

8.129 Types of liquid waste produced and wastewater management practices are the same as for the high and moderate resource scenarios; quantities will be proportionately less. The total volume of sanitary waste due to hydrocarbon related activities in Mobile Bay and Mississippi Sound for the low resource scenario is 240 million gallons.

8.129a The impacts of wastewater on existing wastewater facilities and impacts on the surface waters or groundwater receiving the treated wastes depend upon which wastewater facilities are utilized. The responsible state agency supervises the methods of wastewater disposal and the degree of wastewater treatment available at each facility through the discharge permitting process.

Noise

Approach to Noise Estimates for the Offshore Waters in the Alabama/Mississippi Study Region

8.130 Figure 8-11 depicts the rationale behind the noise level calculations for the offshore waters of Mississippi Sound and the Alabama/Mississippi Gulf of Mexico. The diagram presents the maximum number of active drilling rigs (nine) that can be sited on an offshore leased tract assuming a one-mile minimum distance between rigs. The figure also depicts the location of such a maximum case tract near a sensitive shoreline receptor. The distance from shore is one-half mile for internal Alabama waters and one mile for external Alabama waters and all (general) Mississippi waters. The configuration relates the maximum case (and generally improbable) clustering of nine rigs per tract with five additional rigs located in adjacent tracts at the closest locations to a sensitive receptor point onshore. The total of 14 rigs is based on active rig projections for Mobile Bay under the high resource

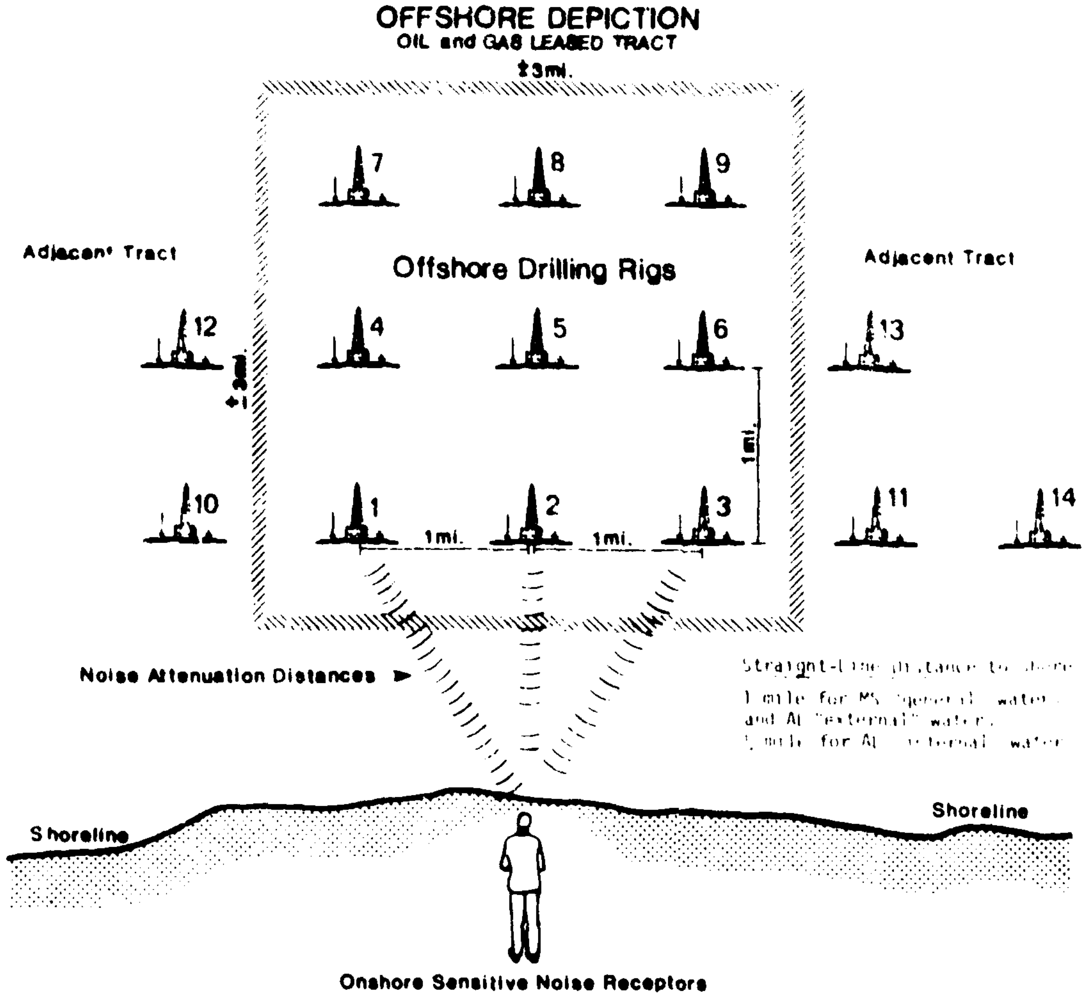


FIGURE 8-11
WORST CASE RESOURCE PROJECTION FOR OFFSHORE ACTIVE DRILLING RIGS WHERE A MAXIMUM 14 RIGS ARE CLUSTERED (NINE PER OIL AND GAS TRACT) WITH THE CLOSEST RIGS LOCATED EITHER ONE MILE (AL EXTERNAL AND MS GENERAL WATERS) OR ONE-HALF MILE (AL EXTERNAL WATERS) FROM SHORE

scenario. For the Mobile Bay high estimates in both the moderate and low resource scenarios the nine rigs closest to shore for internal waters are appropriate (rigs 2, 1, 3, 5, 4, 6, 10, 11, and 8, 12 or 13). For Mississippi Sound waters in Mississippi and Alabama, the high resource scenario results in a range between two and four rigs for the Alabama Gulf waters there would be two to three rigs, and for the Mississippi Gulf waters from zero to two rigs.

8.131 Based on information in Figures 8-2, 8-3, 8-8, and 8-11, and Equations 1, 2 and 3 (Appendix E), estimates for noise attenuation distances, noise levels, and cumulative noise levels can be calculated for rigs located a minimum of one-half or one mile from a given sensitive receptor point on shore.

8.132 As a general rule, it is noteworthy to mention that noise attenuates 6 dB for every doubling of distance for point sources, assuming flat topography and average weather conditions (WAPORA, 1981b).

Alabama Internal Waters - Drilling Rig Installation

8.133 Installation of offshore drilling rigs would result in noise from basic construction equipment. Some of the equipment listed in the Unit Action description is appropriate for offshore rig installation. In addition, the U.S. Army Corps of Engineers, (1982a) reported that the noise generated during the construction of a gas plant would approximately equal 86 dB (L_{eq}), as indicated earlier. Assuming that basic construction of major facilities is similar, this figure was used to calculate drilling rig installation noise values.

8.134 Additional noise is generated by vessel (crewboat, supply boat, tug boat) traffic to the rig site during construction. Bare engine noise levels for some Caterpillar Tractor Company marine propulsion engines are presented in the Unit Action and are appropriate for bare engine noise for smaller tow boats and supply vessels (Caterpillar Tractor Company, 1983). If the cumulative mechanical noise levels and the exhaust noise levels of individual marine propulsion bare engine data are averaged to obtain an average single engine noise level, the mean level is 96 dBA at 23 feet (=84 dBA at 100 feet). However, because bare engine noise data are not realistic in the field since engines typically have mufflers and are enclosed below deck, this noise level is inappropriately high. The average overall attentuation for construction equipment is approximately 8 dBA at 50 feet (=2 dBA at 100 feet). Applying this very approximate correction factor to the average single engine

noise data at 100 feet (84 dBA), marine propulsion noise may approximate 82 dBA at 100 feet per average vessel. However, for the calculations of construction noise of drill rigs with a chosen two attendant vessels, an estimated value of 89 dBA at 100 feet was used.

8.135 The addition of vessel traffic to the assumed basic construction noise level (L_{eq} = 86 dBA) would result in an increase of 1 dBA for one vessel (87 dBA) and 3 dBA for two or three vessels (89 dBA). These figures are approximate since they are based on assumptions and the vessel estimates are added to cumulative values so that they are probably weighted too heavily.

8.136 Maximum Noise Under the High Resource Scenario. According to the resource scenarios, the maximum case for the high resource estimates in Alabama internal waters (Mobile Bay, Alabama Gulf of Mexico, and Alabama portions of Mississippi Sound) is of 14 drilling rigs in Mobile Bay. Based on the offshore depiction of rig arrangement in Figure 8-11 and the scenario rig numbers, all 14 rigs shown would be installed for the worst case high resource projection for Mobile Bay, the closest four rigs (Rigs 2, 1, 3, 5) for the Alabama portions of Mississippi Sound, and the closest three rigs (Rigs 2, 1, 3) for the Alabama Gulf of Mexico. Table 8-12 presents the noise level of each rig (L_{eq} = 86 dBA) attentuated over the respective distance to shore, assuming a one-half mile minimum distance to shore. The rigs are ordered by distance to shore, so that the closest rigs (by assigned rig number) are listed first. Non-straight-line distances from rigs to the shore were calculated by the Pythagorean Theorem. The closest rig from shore (Rig 2 at 2,640 ft) would produce 55 dBA at the onshore receptor site, whereas installation of all others would individually produce 42 dBA or less. The cumulative noise effects are also evident in the table. For all 14 rigs (Mobile Bay) the cumulative effect would be 56 dBA for the four closest rigs in Alabama portions of Mississippi Sound and for the three closest rigs in Alabama portions of Gulf of Mexico. The effect of the closest rig (Rig 2) would be 55 dBA and the cumulative effect of Rig 2 and Rig 1 or 3 (second closest rigs) would also be 55 dBA.

8.137 If the noise from the two attendant vessels is added to the basic construction noise (89 dBA), the noise generated at Rig 2 would be 58 dBA at the onshore receptor site one-half mile away, while all other rig sites would individually generate 44 dBA or less. The cumulative construction noise effect for all 14 rigs in Mobile Bay would be 58 dBA. The four closest rigs in Alabama portions of Mississippi Sound would also be 58 dBA, as would the three closest rigs in the Alabama portion of the Gulf of Mexico. The effect of the construction of one rig or 14 rigs would still be 58 dBA at the receptor site if rigs were arranged according to the figure.

TABLE 8-12

APPROXIMATE DRILLING RIG CONSTRUCTION AND NORMAL OPERATION NOISE LEVELS ATTENUATED OVER DISTANCE AS PERCEIVED BY AN ONSHORE SENSITIVE RECEPTOR (OFFSHORE ALABAMA INTERNAL WATERS)

Number of rigs	Specific rig number (arranged by shortest distance from shore)	Distance from rig to onshore receptor point (feet)	(miles)	Attenuated noise levels: Drilling rig construction noise: Construction only: Indi.	Cumu.	Construction w/2 vessels: Indi.	Cumu.	Drilling rig normal operation: Operation only: Indi.	Cumu.	Operation w/ 3 vessels: Indi.	Cumu.
1	2	2,640	0.50*	55	55	58	58	54	54	58	58
2	1	5,903	1.12	42	55	44	58	41	54	45	58
3	3	5,903	1.12	42	56	44	58	41	55	45	59
4	5	7,920	1.50	35	56	38	58	34	55	38	59
5	4	9,519	1.80	30	56	33	58	29	55	33	59
6	6	9,519	1.80	30	56	33	58	29	55	33	59
7	10	10,885	2.06	26	56	29	58	25	55	30	59
8	11	10,885	2.06	26	56	29	58	25	55	30	59
9	8	13,200	2.50	20	56	23	58	19	55	23	59
10	12	13,200	2.50	20	56	23	58	19	55	23	59
11	13	13,200	2.50	20	56	23	58	19	55	23	59
12	7	14,217	2.69	13	56	20	58	17	55	21	59
13	9	14,217	2.69	18	56	20	58	17	55	21	59
14	14	15,058	3.04	13	56	15	58	12	55	16	59

*Assumed minimum distance to shore for Alabama internal waters (also see Figure 3-9).

8.138 Maximum Noise Under the Moderate Resource Scenario. As indicated by the resource scenarios, the moderate resource projection worst case for Alabama internal waters would be the construction of nine rigs for Mobile Bay, four for Mississippi Sound, and three for the Alabama Gulf of Mexico. The individual and cumulative noise effects of the construction of each rig with or without the addition of two attendant vessels are presented in Table 8-12.

8.139 Maximum Noise Under the Worst Case - Low Resource Scenario. As indicated by the resource scenario figures, the maximum low resource scenario for Alabama internal waters would involve noise under nine rigs for Mobile Bay and two each in the Alabama portion of Mississippi Sound and the Alabama Gulf of Mexico. Individual and cumulative rig installation noise data are presented in the table. The noise data is inclusive and exclusive of attendant vessel noise.

8.140 Minimum Noise Under All Resource Scenarios. Since information in the resource scenario figures indicates that no rigs would be active at certain times during the next 30 years, it is assumed that none would be constructed, thus, no noise effects due to rig construction will be generated.

Alabama Internal Waters - Drilling Rig Normal Operation

8.141 A noise level of 85 decibels at 100 feet was assumed for normal rig operation based on information presented in the Unit Action. It is assumed that this value does not include attendant vessels and that decibels were in dBA. Noise contribution by attendant vessels were based on the assumptions described above so that an average vessel may contribute approximately 82 dBA at 100 feet. The U.S. Army Corps of Engineers, (1982b) reported that three offshore drilling rigs were expected to require three tug boats, two supply boats, four crewboats, and 14 barges (seven usually in the field at one time). Of these, supply and crewboats would make daily trips and tug boats would make three trips per week. Based on these data, an estimate of three vessels per rig per day was assumed for calculations (although they would not be on location all day). Therefore, the cumulative noise level of normal rig operation and the noise produced by three vessels was calculated to be a cumulative 89 dBA at 100 feet and was used for the noise effects calculations.

8.142 Maximum Noise Under the High Resource Scenario. According to information in the resource scenario figures, the most noise for the high resource case in the Alabama internal waters of Mobile Bay is 14 drilling rigs; for the Alabama portion of Mississippi Sound the most is four rigs, for the Alabama Gulf of

Mexico it is three rigs. The configuration of the 14 rigs depicted in Figure 8-11 would be appropriate for Mobile Bay, while the closest four rigs (Rigs 2, 1, 3, 5) and the closest three rigs (Rigs 2, 1, 3) are appropriate for the respective Alabama portions of Mississippi Sound and Alabama Gulf of Mexico high resource worst case scenarios.

8.143 Normal operation of a drilling rig would produce 54 dBA one-half mile from shore (Rig 2) while all others would individually contribute 41 dBA or less at their respective distances from the onshore noise receptor. The cumulative effects of various drilling rigs is also presented in Table 8-13. Data indicate that the normal operation of all 14 rigs in Mobile Bay would be 55 dBA. The four closest rigs in the Alabama portion of Mississippi Sound would be 55 dBA, and the three closest rigs in the Alabama Gulf of Mexico would also be 55 dBA. In general, the effect of adding the second closest rig (1 or 3) to the closest rig (2) would not increase the cumulative noise level (54 dBA, rounded to whole number). The cumulative addition of the next closest rig (3 or 1) would result in an increase of 1 dBA (55 dBA). This level would not increase if all 14 rigs were added, if rigs were located as in Figure 8-11.

8.144 If the noise of three attendant vessels are added (89 dBA), the noise contribution by the closest rig (2) one-half mile from shore would be 58 dBA. All others would individually produce 45 dBA or less. Cumulative additions indicate that the addition of the closest rig (Rig 2 at 58 dBA) with the next closest (Rig 1 or 3) would not increase the while number noise level (58 dBA). Addition of the next closest rig (Rig 3 or 1) or all 14 rigs would cause an increase of 1 dBA to 59 dBA. The cumulative effects for the high resource scenario for the Mobile Bay Alabama portion of Mississippi Sound, and Alabama Gulf of Mexico is 55 dBA for normal rig operation and 59 dBA for normal rig operation with three attendant vessels.

8.145 Maximum Noise Under the Moderate Resource Scenario. As indicated by the resource scenario figures nine, four, and three rigs are likely for the high range of the moderate resource in the Alabama internal waters of Mobile Bay, Alabama portion of Mississippi Sound, and Alabama Gulf of Mexico, respectively. Individual and cumulative noise data are displayed in Table 8-12. Cumulative data for the nine, four, and three closest rigs is 55 dBA (normal rig operation) and 59 dBA (normal rig operation with three attendant vessels).

8.146 Maximum Noise Under the Low Resource Scenario. The number of active rotary rigs for the high range of low resource scenario is nine for Mobile Bay and two each for the Alabama portion of Mississippi Sound and Alabama Gulf of Mexico. Individual and cumulative noise data are presented in Table 8-12. Cumulative

TABLE 8-13

POTENTIAL DAILY MAXIMUMS OF WATERWAY TRAFFIC INCREASE IN MOBILE BAY

Phase	High Scenario[a] Barge Trips	High Scenario[a] Crew Boat Trips	Moderate Scenario[b] Barge Trips	Moderate Scenario[b] Crew Boat Trips	Low Scenario[a] Barge Trips	Low Scenario[a] Crew Boat Trips
Drilling						
Site Preparation	0	0	3	3	3	3
Routine Operations	26	39	8	12	14	21
Production						
Well Completion	8	24	4	12	4	12
Platform Installation	12	24	12	24	9	18
Normal Operations	0	6	0	5	0	5
Other Traffic						
Mobile Bay Traffic	46	93	27	56	30	59
Traffic from Federal Waters	8	56	5	38	1	9
Total	54	149	32	94	31	68

[a]Scenario Year 8
[b]Scenario Year 9

effects for the [illegible] nine rigs is [illegible] dBA ([illegible] dBA with the addition of three vessels) and for the closest two rigs it is [illegible] dBA ([illegible] dBA with the addition of three vessels).

8.147 Minimum Noise All Resource Scenarios. The minimum noise produced for all resource scenarios is zero rigs, resulting in no noise impact from drilling rig operation and no need for attendant vessels.

Alabama Internal Waters - Pipeline Construction

8.148 Noise levels for pipelaying activities in internal waters are expected to generally be comparable to, but probably less than, dry land or wetland operations (see Unit Action). Based on the average mechanical and exhaust base engine unmuffled noise levels of the 250-horsepower pumps presented in the Unit Action an approximate 78 dBA at 100 feet could result. Since this figure is lower than noise generated for dry land trenching and because certain land pipelaying activities such as clearing, grading, and backfilling can be disregarded, it is estimated that estuarine pipelaying noise is less than the dry land operation. This is assumed despite the need for a tug boat to assist the bury barge. Therefore, the noise level used to calculate Mobile River Delta pipelaying levels (L_{eq} = 86 dBA at 100 feet) may roughly also be appropriate for estuarine areas, but is probably somewhat high. In order to calculate some cumulative impacts for estuarine operations, a range from 80 to 85 dBA at 100 feet is used.

8.149 Maximum Noise. The maximum noise under the high resource scenario is assumed to be the same as described for the Mobile River Delta where two pipelines are being simultaneously constsructed one mile apart. The attenuated noise impact for an equidistant receptor one-half mile from each pipelaying operation would be 49, 50, 51, 52, 53, and 54 dBA for the assumed pipelaying operation noise levels of 80, 81, 82, 83, 84, and 85 dBA at 100 feet, respectively.

8.150 Minimum Noise. No construction of additional pipelines would result under the low range. This would imply no additional noise due to pipeline construction.

Threatened and Endangered Species

8.150a Threatened and endangered species in Mobile Bay could be affected by collisions with vessels, temporary alteration of habitat during routine operations or by accidental spills of liquid hydrocarbons. Because of the rare occurrence of manatees or sea turtles in Mobile Bay, loss from collisions with vessels is unlikely.

Temporary habitat alteration is also unlikely to have a significant effect.

8.150b The effect of a spill of hydrocarbon liquids would depend on the size of the spill and the area affected by the spill. A large uncontained spill that affected a large area of the bay could have a significant effect on local populations of endangered or threatened birds. Of particular concern would be the recently established nesting population of brown pelicans on Guilliard Island. Such a spill has a very low probability of occurrence in Mobile Bay because of the very low probability for the discovery of crude oil and the possible low liquid content of gas likely to be discovered.

8.150c A smaller spill could have a localized effect in the vicinity of the affected area. The significance of such a spill on threatened and endangered species would depend on the site-specific circumstances at the location of the spill.

Commercial Fisheries

8.151 There are three general categories of potential impacts that the postulated levels of hydrocarbon development could produce: direct loss of fishing area, interference with fishing operations, and space competition between fishing fleet traffic and oil rig traffic.

Loss of Fishing Area

8.152 For the various rig types and the platforms that would be used in the Bay, approximately 3/4 to 1 or 1-1/4 acres would be encompassed by a rig or platform and its adjacent support vessel moorings. The highest removal of acreage would occur when the maximum number of platforms is developed (for each scenario), since the platform area would be removed as potential fishing locations for the 20 year life of the wells. For the low, moderate and high scenarios (12 to 15 platforms), the acreage thus taken in the Bay would range from 9 to 15 acres.

Fishing Vessel Maneuvering

8.153 A second area of potential fisheries impact is the possible conflict between the location of a drilling rig or platform and the maneuvering of a fishing vessel while actively fishing. A fishing vessel towing a net (e.g., an otter trawl) needs a larger maneuvering area while underway then the fishing vessel by itself requires. This is particularly the case when turning. In order to

avoid any drilling rig or platform and to give an extra margin of safety since a fishing captain cannot know precisely the location of a net under tow, a drilling rig could generally be fished no closer than 150 to 200 feet (Centaur Associates, Inc., 1981). This would effectively close 4 to 7 acres around a rig or platform to any commercial fishing using towed nets. For the 12 to 15 platforms postulated for the low, moderate and high scenarios, this would produce a total of approximately 50 to 100 acres in which trawling or other fishing operations could be restricted.

8.154 Another potential impact to fishing vessel maneuvering could occur in connection with gathering line installation. During a year of high levels of gathering line installation (years 6 or 8, high scenario), approximately 45 miles of pipeline would be installed. Until such time as pipeline trenches are backfilled, the dredged material pile could prevent fishing boats from crossing the area of the pipeline or could impede trawling operations. Irregularities or mud lumps on the bottom pipeline following installation could affect trawling operations.

Space Competition Between Fishing Vessels and Oil Rig Vessels

8.155 Although the various oil rig vessels would add to the volume of waterway traffic (see Navigation section, below), it is not expected that the rig-related vessel traffic would be of such a level as to interfere with fishing boats going to and from their home ports. Many of the fishing boats leave port in the very early hours before the rig traffic would start and, depending on type of fishing, fishing success and weather conditions, would return at various times throughout the day and night.

8.156 An area of potential conflict could be the competition for dock space between fishing vessels and oil rig vessels. In competition for existing dock space, an oil company would be able to outbid the fishing interests. However, it is not expected that hydrocarbon development companies would need large dock areas since many supplies would be barged from sources in Louisiana (or Texas) and crew transfer points require only a parking lot and a relatively small dock. Additionally, if such companies do develop new dockage areas for staging and crew transfer points, such docks could be of potential use to the fishing industry (or other water-oriented industries) after the oil and gas operations have been terminated.

Cultural Resources

8.157 As a result of comments by the Alabama State Historic Preservation Officer on previous permits for oil and gas development in Mobile Bay, the Mobile District has required that a cultural resources survey be performed to identify potential resources prior

to any project. Following a literature and records search, a multi-sensor survey (including a marine magnetometer, and shallow seismic profiler or bottom coring device) of a proposed development location is run to identify any indications of cultural remains. Such surveys are expected to remain standard practice in the environmental review of any project. Should the multi-sensor survey identify a potential location of cultural remains, then either additional survey work is required to determine the nature of the potential site or the proposed project activities would be modified to avoid the location.

8.158 If evidence of cultural resources is found during the survey, an intensive field survey would be performed to delineate the extent of the remains in relation to those areas that could be disturbed by proposed project activities. Prior to the issuing of any permit, any conflicts regarding the potential impacts to cultural resources due to project activities must be resolved.

Navigation

8.159 Based on the data from the resource development scenarios for Mobile Bay (Figure 8-2) and on the assumptions described in Appendix F, the potential daily maximums of waterway traffic increase were calculated for the projected hydrocarbon development activities in Mobile Bay (Table 8-13). This table also includes estimated traffic increases in the Bay due to hydrocarbon operations in federal waters. Although exact drilling locations cannot be projected, it is expected that potential traffic increases would be distributed around the Bay with a heavier concentration in the lower Bay. Additionally, it is expected that the land-based crew transfer points or staging areas for Bay development would be in the Mobile area, the Theodore Industrial Park and Bayou La Batre and much of the traffic increases would concentrate on routes between the drilling and production locations and these staging areas. Barge traffic, particularly waste barge traffic, would primarily travel from the various Bay drilling areas to the Intracoastal Waterway and into or through Mississippi Sound. It would be expected that with increasing developments efficient drilling waste disposal capacity would be established in the region and waste barge traffic would not need to traverse the entire Mississippi Sound as has been necessary with some recent exploratory drilling.

8.160 In addition to the increases in local waterway traffic, another area of potential navigation impacts involves the establishment of production platforms in the Bay. Such platforms would be permanent structures for the life of the different fields established. Based on the various levels of the resource development scenarios, the number of platforms constructed would range from 12 to 15. However, regulations and regulated areas have been

established to minimize such potential impacts. Specifically, the regulations in 33 CFR 67 provide direction on aids to navigation for fixed structures and these regulations cover general requirements for lights and fog signals, including their arrangement, location and operating characteristics. In addition, safety fairways have been established parallel to designated navigation channels and these fairways provide a minimum separation of one-half between a structure and a navigation channel. (Additional information on the safety fairway system is presented in the Chapter 5 section on the navigation impacts of site preparation activities for well drilling.)

Spills and Loss of Well Control

Accident Conditions

8.161 As was discussed for the Mobile River Delta, accidents are more likely to occur under the high resource scenario than under the other scenarios. Accident probabilities in terms of numbers of accidents associated with rigs and pipelines would be higher for Mobile Bay and Mississippi Sound than for open waters, because more rigs and longer lengths of pipelines would be in place per square mile of the Bay or Sound. In addition, pipelines from both Federal and state Gulf platforms, as well as pipelines from platforms in the bay/sound, would cross either Mobile Bay or Mississippi Sound.

8.162 Quantities of hydrocarbons or wastes spilled at a processing or waste treatment facility could increase to higher levels under the high resource scenario than under low resource scenario because of the sizes rather than the number of processing and waste treatment facilities are higher.

8.163 No oil is anticipated to be extracted from Mobile Bay or Mississippi Sound, except for small quantities from Mobile Bay under the high resource scenario. Furthermore, quantities of natural gas liquids from Mobile Bay are anticipated to be five to ten times larger than quantities from Mississippi Sound. Therefore, from a water quality standpoint the primary concerns within the Mobile Bay and Mississippi Sound are oil pipleines from Federal waters and drilling fluids, formation waters, waste fuels, solvents and other chemicals from barges, rigs, and platforms in the area, in addition to natural gas liquid in pipelines from Federal waters and Mobile Bay.

8.164 Shallow waters which primarily oscillate in a back and forth manner do not provide large amounts of dilution for soluble or floating chemicals. Drilling muds/fluids can settle to bottom sediments, particularly when tidal velocities are low between flood

and ebb tides. Waters reside in Mobile Bay and Mississippi Sound for longer periods of time than in channels of the Mobile River Delta. Consequently, spills of oil from Federal waters or waste chemicals could result in long-term residual adverse effects which can cumulate if subsequent spills occur. Impacts from natural gas spills on water quality are largely not known, although methane and hydrogen sulfide should bubble to the water surface and be released to the atmosphere in close proximity to a spill.

8.165 Because pipelines from the Gulf of Mexico will most probably not traverse barrier islands, these pipelines could aggregate at eastern and western ends of barrier islands. If pipelines do aggregate, then the probability of a pipeline spill increases, particularly at locations where ships temporarily anchor and hence damage to pipes from anchor dragging is more likely to occur. Passes between barrier islands are also subject to extensive scour which could expose pipelines more easily than in slower-moving waters.

8.166 Pipelines from federal water will traverse Mobile Bay or Mississippi Sound, penetrate adjacent shoreline and then cross upland or wetland areas in order to reach processing facilities. Oil pipelines and natural gas liquid pipelines are of particular concern from a water quality standpoint, assuming that natural gas would be released to the atmosphere near any spill site. Pipeline route selection should take into consideration environmental as well as economic and safety factors.

Accidental Release of Natural Gas Containing Hydrogen Sulfide

8.167 The pipeline mileages for Mobile Bay that are presented in the resource development scenarios at the beginning of this chapter include those pipelines from wells in the bay and additional pipelines from adjacent state waters that cross parts of Mobile Bay. In addition to the pipelines connected with development in the Bay and adjacent state waters, pipelines from development in the Federal OCS waters would also cross this area. The probability of an accidental release of natural gas from pipelines was calculated using a modified pipeline leak detection model (Appendix E). The incident frequencies for pipelines in Mobile Bay, both with and without the Federal OCS pipeline segments, are given in Table 8-14.

ENVIRONMENTAL CONSEQUENCES IN MISSISSIPPI SOUND

8.168 Potential effects associated with the hydrocarbon resource development scenarios on the biological and physical environment of Mississippi Sound are discussed in this section.

TABLE 6-14

PIPELINE RELEASE INCIDENT FREQUENCY
MOBILE BAY PIPELINES

Resource Scenario	Pipeline Mileage	Incident Frequency[a] (in years)
	Mobile Bay Pipelines Only	
High	118	6.1
Moderate	109	6.7
Low	87	8.3
	Mobile Bay with Federal OCS Pipelines	
High	145	5
Moderate	136	5.3
Low	93	7.8

[a]Incident - any pipeline release, from the smallest possible leak to a pipeline rupture.

Frequency - the number of years for such an incident to occur.

Water Quality

8.169 Impacts on water quality and hydrology for the various development scenarios have been discussed in the Mobile Bay section.

Wetland Ecosystems

8.170 Oil and gas drilling and recovery operations as postulated in the development scenarios are unlikely to have a large effect on saltmarsh wetlands of Mississippi Sound if drilling sites and pipeline routes are selected carefully.

Drilling Sites

8.171 Only a few wetland areas could not be reached by directional drilling in saltmarshes adjacent to Mississippi Sound. These are areas near Mon Louis Island, the Grande Batture Islands, and the area between Waveland and the mouth of the Pearl River. Since so few drilling sites are postulated for Mississippi Sound (2 sites for the low and moderate scenarios and 8 sites for the high scenario), it is likely that a permit for drilling in wetlands may never be requested. If undertaken, all drilling could probably be accomplished from one site in each area. Use of an inland drilling barge would alter the most area, possibly 85 acres for canals and slips if all 3 sites are drilled. Use of other drilling alternatives would require less area. Loss of a maximum of 85 acres TABLE 8-14of wetland would be small compared to the existing 77,000 a cres of wetlands in Mississippi Sound but would be an incremental addition to the 10,000 wetland acres already lost from other activities.

Pipelines

8.172 Under the resource development scenarios, only a few pipeline landfalls would be required in Mississippi Sound. In much of the Sound, landfalls could probably be selected that would not require crossing wetlands. Landfalls in eastern Mississippi Sound would probably require crossing some wetland area. Careful site selection could minimize the area affected. With adequate site restoration any effects would be temporary.

Aquatic Ecosystems

8.173 Pipeline construction would be the activity that would affect the largest area in Mississippi Sound. Area required by drilling sites would be very small. Other production and abandonment activities would have only minor effects at the well

sites. With the possible exception of the shallow areas from Bayou Cassotte to the Dauphin Island Bridge, resource development activities would probably have only a small effect on the Mississippi Sound ecosystem.

Calculation of Benthic Area Affected

8.174 The area of benthic habitat disturbed yearly by drilling sites and pipeline construction (Figure 8-12) has been calculated from Figures 8-3 and 8-6 and from information on Unit Actions in Chapter 5. Only area affected by pipeline construction is plotted because the area affected by drilling sites would be small. The proportion of pipeline miles from federal waters that would traverse Mississippi Sound was estimated by assuming 35 percent of the volume of hydrocarbon from federal waters would come onshore through Mississippi Sound, mainly in large diameter trunk lines.

Effects on Aquatic Ecosystems

8.175 Benthic alterations from drilling sites and pipeline construction would be spread out in time (Figure 8-12) so that the total area affected at one time would be small. The greatest disturbance would occur in year 8 in the high scenario when about 1100 acres would be affected. In Mississippi waters, buffer areas have been established around important benthic resources, such as oyster reefs and seagrass beds, which should adequately protect these resources from drilling and construction activities. In Alabama waters, the one-half mile drilling exclusion zone along the shoreline should protect the seagrass beds along the northern shore of Dauphin Island.

8.176 Water shallower than 6 feet deep occurs along the northern shore of Mississippi Sound from about Biloxi east to the Dauphin Island Bridge. These shallow waters and adjacent wetlands are important as nursery areas for many juvenile fish and shellfish. In Alabama waters, the shallow areas of Portersville Bay and the area just west of Cedar Point and the Dauphin Island Bridge are designated as regulated shrimp nursery areas. Extensive oyster reefs and oyster bottoms also occur in these shallow waters.

8.177 Dredging of access channels would be required to reach drilling sites in these shallow waters or in adjacent wetlands. Benthic disturbance and turbidity could affect these important areas. Pipeline construction could also disturb biological resources in the shallow waters. With careful control of turbidity and restoration of the right-of-way, pipeline construction would be only a temporary effect.

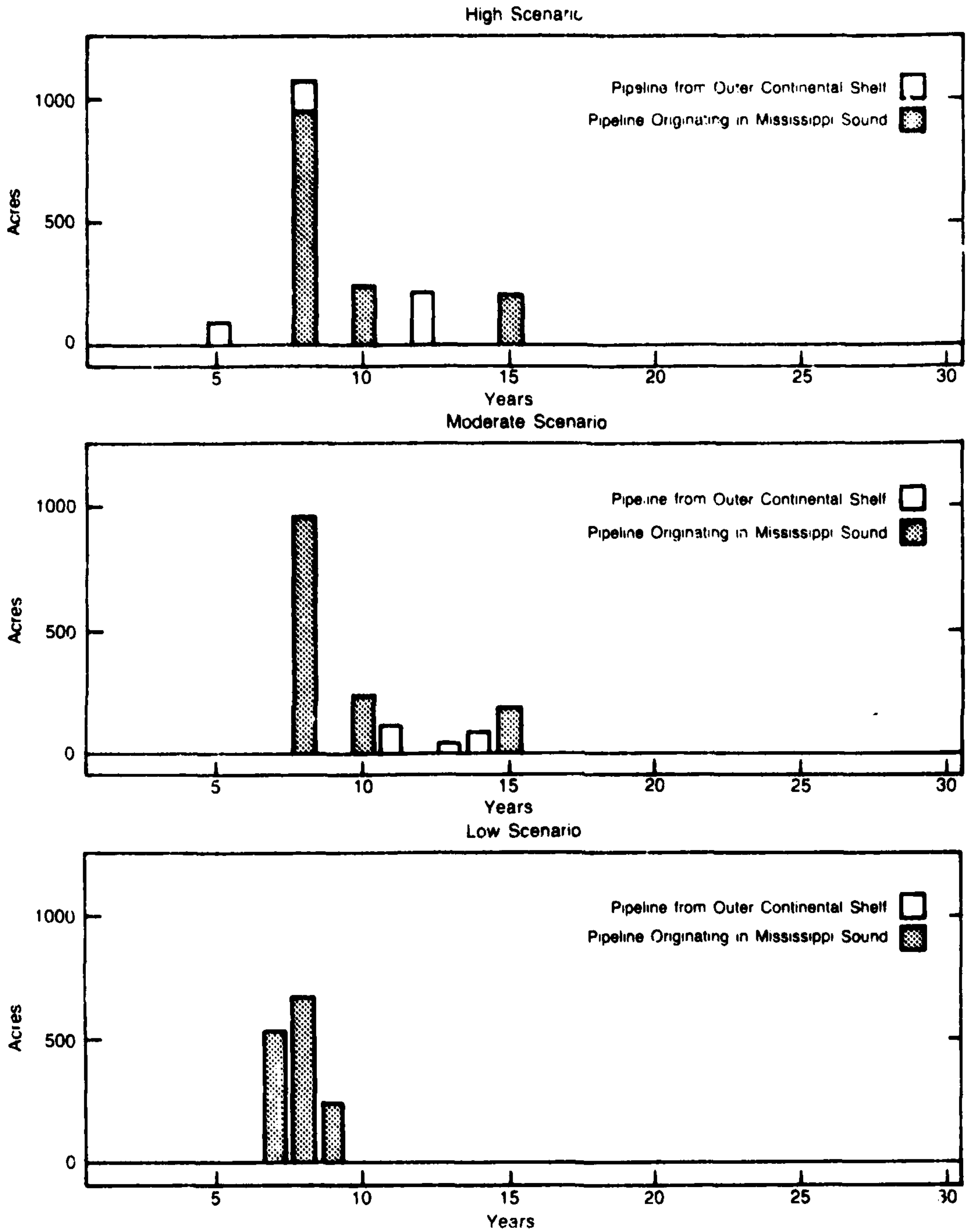


FIGURE 8-12
AREA REQUIRED FOR PIPELINE CORRIDORS IN MISSISSIPPI SOUND FOR THE RESOURCE DEVELOPMENT SCENARIOS

Groundwater

Impacts Due To Chlorides

8.178 Overall drilling activity within this area is expected to be considerably less than for Mobile Bay. Active drilling activity will primarily be concentrated between years 3 and 12, peaking generally in year 9 for the high and moderate resource cases and years 5 to 7 for the low case. As discussed previously in the Delta section, overall chloride contamination potential would probably follow these activity trends.

8.179 Brine production, handling and disposal for these areas should pose less of a potential for groundwater pollution based upon the relatively low volume expected to be produced. Figure 8-13 shows expected brine production for Mississippi Sound based upon criteria discussed previously in the Delta section. As can be noted, expected volumes are low.

8.180 The potential for chloride contamination from drilling muds will be similar to that described for the Delta region. The potential for chloride contamination due to mud disposal would also be as discussed for the Delta.

Impacts Due to Heavy Metals, Chemicals or Hydrocarbons

8.181 Some potential exists for such contamination by way of drilling mud contact with freshwater aquifers during the drilling phase. This potential would be the same as discussed for the Mobile River Delta and Mobile Bay subregions.

8.182 Hydrocarbons expected within this area would be in the form of gas or condensates. Therefore, it would be expected that fracturing would be utilized for enhancement and pollution probabilities will be similar to that discussed for Mobile Bay. Most enhancement activity would be expected either initially or following production decline in about year 14.

Wastewater Disposal

8.183 Volumes of wastewater to be disposed have been given in the Mobile Bay section.

Noise

8.184 The maximum and minimum noise levels under the high, moderate and low scenarios generated from activity in Mississippi Sound, are discussed in the following section in conjunction with activities in state waters in the Gulf of Mexico.

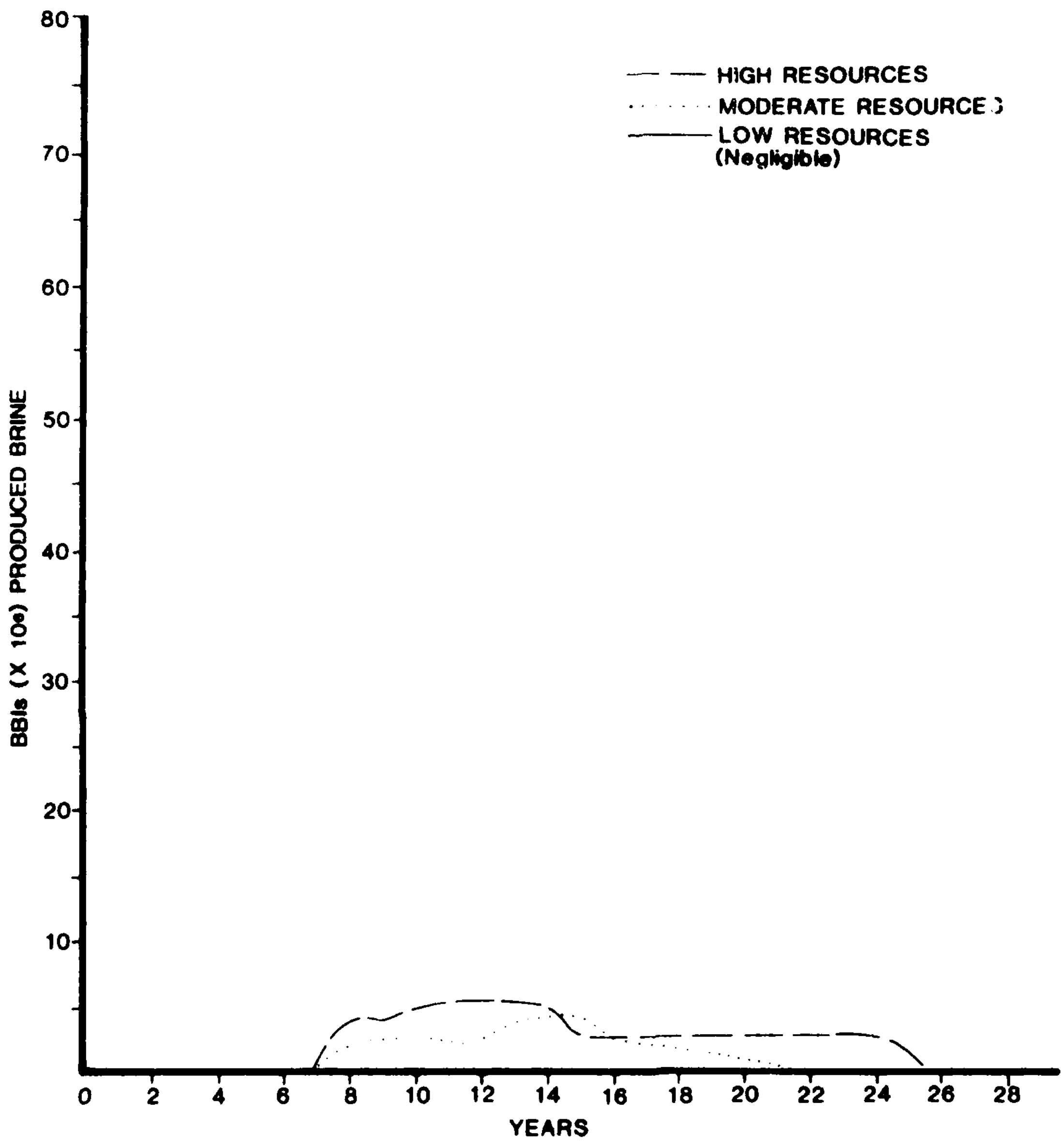


FIGURE 8-13
BRINE PRODUCTION BY RESOURCE CASE FOR MISSISSIPPI SOUND

Threatened and Endangered Species

8.184a Threatened endangered species in Mississippi Sound could be affected by collisions with vessels, temporary alteration of habitat during routine operations or by accidental spills of liquid hydrocarbons. Because of the rare occurrence of manatees or sea turtles in Mississippi Sound, loss from very infrequent collisions with service vessels is unlikely to affect regional populations. Temporary habitat alteration is also unlikely to have a significant effect on regional populations.

8.184b The effect of a spill of hydrocarbon liquids would depend on the size of the spill and the area affected by the spill. A large uncontained spill that affected a large area of the sound could have a significant effect on local populations of endangered or threatened birds or sea turtles in the sound at the time. Such a spill has a very low probability of occurrence in Mississippi Sound because of the very low probability for the discovery of crude oil and the possible low liquid content of gas likely to be discovered.

8.184c A smaller spill could have a localized effect in the vicinity of the affected area. The significance of such a spill on threatened and endangered species would depend on the site-specific circumstances at the location of the spill.

Commercial Fisheries

8.185 There are three general categories of potential impacts that the postulated levels of hydrocarbon development could produce: direct loss of fishing area, interference with fishing operations, and space competition between fishing fleet traffic and oil rig traffic.

Loss of Fishing Area

8.186 For the various rig types and the platforms that would be used in the Sound, approximately 3/4 to 1 or 1-1/4 acres would be encompassed by a rig or platform and its adjacent support vessel moorings. The highest removal of acreage would occur when the maximum number of platforms is developed (for each scenario), since the platform area would be removed as potential fishing locations for the 20 year life of the wells. For the low, moderate and high scenarios (2 to 5 platforms) the acreage thus taken in the sound would range from 1-1/2 to 5 acres.

Fishing Vessel Maneuvering

8.187 A second area of potential fisheries impact is the possible conflict between the location of a drilling rig or platform and the maneuvering of a fishing vessel while actively fishing. A fishing vessel towing a net (e.g., an otter trawl) needs a larger maneuvering area while underway then the fishing vessel by itself requires. This is particularly the case when turning. In order to avoid any drilling rig platform and to give an extra margin ofsafety since a fishing captain cannot know precisely the location of a net under a tow, a drilling rig could generally be fished no closer than 150 to 200 feet (Centaur Associates, Inc., 1981). This would effectively close 4 to 7 acreas around a rig or platform to any commercial fishing using towed nets. For the 2 to 5 platforms postulated for the low, moderate and high scenarios, this would produce a total of approximately 8 to 35 acreas in which trawling or other fishing operations could be restricted.

8.188 Another type of potential fishing vessel impact involves purse seining operations. Such operations are used in the Sound in the taking of menhaden. In purse seining, a long net is pulled by a small skiff around a school of fish and then a line at the bottom of the net is pulled, causing the bottom to close or purse. The closed net is pulled in by the larger seine vessel, gradually making the enclosed pond smaller until the fish are alongside the larger vessel where they are loaded into the vessel by dip net or suction pump. While the net is being pulled to encircle the school of fish and as the net is being pursed, the net and seine vessel are susceptible to the winds and current. Encircling a school and pursing a net typically takes about 30 minutes (Centaur Associates, 1981). In wind and current conditions producing a two mile per hour drift, the net and vessel could move one mile before the vessel can maneuver itself and the loaded net. In order to represent the uncertainty in knowing the precise drift direction, an angle of 30 degrees at a rig or platform is assumed which, when combined with the one-mile drift distance, produces a triangular area that would be effectively closed to purse seining operations. Such a triangle would have an area of about one quarter square mile or about 160 acres. Since menhaden, the fish of principal interest in purse seining in the region, form definite schools and are not evenly distributed over the area, the presence of several platforms does not necessarily increase the area of potential closure, but rather increases the probability of such a closure area affecting fishing operations.

8.189 Another potential impact to fishing vessel maneuvering could occur in connection with gathering line installation. During a year of high levels of gathering line installation (year 8, high scenario), approximately 47 miles of pipeline would be installed. Until such time as pipeline trenches are backfilled, the dredged

material pile could prevent fishing boats from crossing the area of the pipeline or could impede trawling operations. Irregularities or mud lumps on the bottom following pipeline installation could affect trawling operations.

Space Competition Between Fishing Vessels and Oil Rig Vessels

8.190 Although the various oil rig vessels would add to the volume of waterway traffic (see Navigation section, below), it is not expected that the rig-related vessel traffic would be of such a level as to interfere with fishing boats going to and from their home ports. Many of the fishing boats leave port in the very early hours before the rig traffic would start and, depending on type of fishing, fishing success and weather conditions, would return at various times throughout the day and night.

8.191 An area of potential conflict could be the competition for dock space between fishing vessels and oil rig vessels. In competition for existing dock space, an oil company would be able to outbid the fishing interests. However, it is not expected that hydrocarbon development companies would need large dock areas since many supplies would be barged from sources in Louisiana (or Texas) and crew transfer points require only a parking lot and a relatively small dock. Additionally, if such companies do develop new dockage areas for staging and crew transfer points, such docks could be of potential use to the fishing industry (or other water-oriented industries) after the oil and gas operations have been terminated.

Cultural Resources

8.192 For oil and gas development in the Alabama portion of Mississippi Sound, the Mobile District has required that a cultural resources survey be performed to identify potential resources prior to any project activities. Following a literature and records search, a multi-sensor survey (including a marine magnetometer and shallow seismic profiler or bottom coring device) of a proposed development location is run to identify any indications of cultural remains. Such surveys are expected to remain standard practice in the environmental review of any project. Should the multi-sensor survey identify a potential location of cultural remains, then either additional survey work is required to determine the nature of the potential site or the proposed project activities would be modified to avoid the location.

8.193 If evidence of cultural resources is found during the survey, an intensive field survey would be performed to delineate the extent of the remains in relation to those areas that could be

disturbed by proposed project activities. Prior to the issuing of any permit, any conflicts regarding the potential impacts to cultural resources due to project activities must be resolved.

Navigation

8.194 Based on the data from the resource development scenarios for Mississippi Sound (Figure 8-3) and on the assumptions described in Appendix F, the potential daily maximums of waterway traffic increase were calculated for the projected hydrocarbon development activities in Mississippi Sound (Table 8-15). This table also includes estimated traffic increases in the sound due to operations in federal waters (Figure 8-6). Because of the fewer postulated development areas (compared to Mobile Bay or the Delta) and to the greater number of areas of potential use as staging areas, the potential waterway traffic increases would probably be more evenly distributed around the Sound with perhaps a slightly higher concentration in the eastern portion of the Sound with staging areas or crew transfer points at Bayou La Batre or Pascagoula-Bayou Casotte.

8.195 In addition to the increases in local waterway traffic, another area of potential navigation impacts involves the establishment of production platforms in the Sound. Such platforms would be permanent structures for the life of the different fields established. Based on the various levels of the resource development scenarios, the number of platforms constructed would range from 2 to 5. However, regulations and regulated areas have been established to minimize such potential impacts. Specifically, the regulations in 33 CFR 67 provide direction on aids to navigation for fixed structures and these regulations cover general requirements for lights and fog signals, including their arrangement, location and operating characteristics. In addition, safety fairways have been established parallel to designated navigation channels and these fairways provide a minimum separation of one-half mile between a structure and a navigation channel. (Additional information on the safety fairway system is presented in the Chapter 5 section on the navigation impacts of site preparation activities for well drilling.)

Spills and Loss of Well Control

8.196 Discussion of spills in Mississippi Sound has been given in Mobile Bay section. Water velocities are generally lower in Mississippi Sound than in Mobile Bay, based on available data. Hence, times for spills to travel a particular distance would be longer in Mississippi Sound than in Mobile Bay.

TABLE 8-15

POTENTIAL DAILY MAXIMUMS OF WATERWAY TRAFFIC INCREASE IN MISSISSIPPI SOUND

Phase	High Scenario[a] Barge Trips	High Scenario[a] Crew Boat Trips	Moderate Scenario[b] Barge Trips	Moderate Scenario[b] Crew Boat Trips	Low Scenario[a] Barge Trips	Low Scenario[a] Crew Boat Trips
Drilling						
Site Preparation	3	3	0	0	0	0
Routine Operations	4	6	8	12	2	3
Production						
Well Completion	6	18	2	6	2	6
Platform Installation	6	12	0	0	0	0
Normal Operations	0	2	0	2	0	2
Other Traffic						
Mississippi Sound Traffic	19	41	10	20	4	11
Traffic from Federal Waters	10	74	7	50	2	12
Totals	29	115	17	70	6	23

[a]Scenario Year 8
[b]Scenario Year 9

Accidental Release of Natural Gas Containing Hydrogen Sulfide

8.197 The pipeline mileages for Mississippi Sound that are presented in the resource development scenarios at the beginning of this chapter include those pipelines from wells in the sould and additional pipelines from adjacent state waters that cross the Sound. In addition to the pipelines connected with development in the Sound and adjacent state waters, pipelines from development in the Federal OCS waters would also cross this area. The probability of an accidental release of natural gas from pipelines was calculated using a modified pipeline leak detection model (Appendix E). The incident frequencies for pipelines in Mississippi Sound, both with and without the Federal OCS pipeline segments, are given in Table 8-16.

ENVIRONMENTAL CONSEQUENCES IN ALABAMA AND MISSISSIPPI STATE WATERS OF THE GULF OF MEXICO

8.198 Potential effects associated with the hydrocarbon resource development scenarios on the biological and physical environment of the nearshore Gulf of Mexico are discussed in this section.

Water Quality and Hydrology

8.199 The major surface water impacts from hydrocarbon development in the state waters of the Gulf of Mexico fall into the same major categories listed for Mobile Bay and Mississippi Sound, except that the waters are deep enough that there would be no need for dredging and there would be less, if any, scouring of bottom sediments from boat traffic. With no access channels to cause impacts, there would be no cumulative impact on surface waters from hydrocarbon development in the state waters of the Gulf.

Aquatic Ecosystems

8.200 Pipeline construction would be the main agent of disturbance in the state waters of the Gulf of Mexico. Only a very small area would be affected by drilling sites. Other production and abandonment activities would have only minor effects at the well sites. In general, these activities would probably have only a small overall effect on the nearshore ecosystem in state waters of the Gulf of Mexico. Because of the concentration of pipeline corridors through the inlet to Mobile Bay, and to a lesser extent, through Petit Bois Pass at the western end of Dauphin Island that is likely to occur, some temporary localized effects in these areas could occur during the years of peak pipeline construction activity.

TABLE 8-16

PIPELINE RELEASE INCIDENT FREQUENCY
MISSISSIPPI SOUND PIPELINES

Resource Scenario	Pipeline Mileage	Incident Frequency[a] (in years)
	Mobile Bay Pipelines Only	
High	58	12.5
Moderate	58	12.5
Low	60	12.1
	Mobile Bay with Federal OCS Pipelines	
High	68	10.7
Moderate	68	10.7
Low	62	11.7

[a]Incident - any pipeline release, from the smallest possible leak to a pipeline rupture.

Frequency - the number of years for such an incident to occur.

Calculation of Benthic Area Affected

8.201 The area of benthic habitat disturbed yearly by drilling sites and pipeline construction (Figure 8-14) has been calculated from Figures 8-4, 8-5 and 8-6 and from information on unit actions in Chapter 6. Only the area affected by pipelines is plotted because of the small total area affected by drilling sites. The proportion of pipeline miles from federal waters that would traverse Alabama and Mississippi state waters of the Gulf were estimated by assuming that 85 percent of the postulated volume of hydrocarbon from federal waters would flow through Alabama waters and 15 percent through Mississippi waters, mainly in large diameter trunk lines.

Effects on Aquatic Ecosystems

8.202 The benthic area altered would probably be mostly in Alabama waters (Figure 8-14), especially in the vicinity of the inlet to Mobile Bay, where many trunk lines to shore would converge. Under all scenarios the total area newly affected each year would be small. For the high and moderate scenarios, pipeline activities would be fairly constant, however, for years 4 through 10 or 11.

8.203 Recovery of disturbed benthic area should be relatively rapid. If pipelines through the inlet to Mobile Bay are constructed close together in time, some local effect could result during the construction period from the destruction of benthic communities. Passes between the barrier islands linking Mississippi Sound and Mobile Bay with the Gulf of Mexico are the migration corridors for many species whose life cycle includes time spent in both environments. The concentration of pipeline laying activities that may occur in the vicinity of the pass to Mobile Bay could result in turbidity that possibly could have some effect on migration of larvae, juveniles and adults through this pass. The extent of this effect, if any, would be a function of how extensive the turbidity plumes were and how continuous was the existance of these plumes.

Groundwater

Impacts Due to Chloride

8.204 Overall drilling activity within these areas is expected to be considerably less than for Mobile Bay. Active drilling activity will primarily be concentrated between years 5 and 11, peaking generally in year 9 for the high and moderate resource cases. The low resource case remains constant at one rig per year.

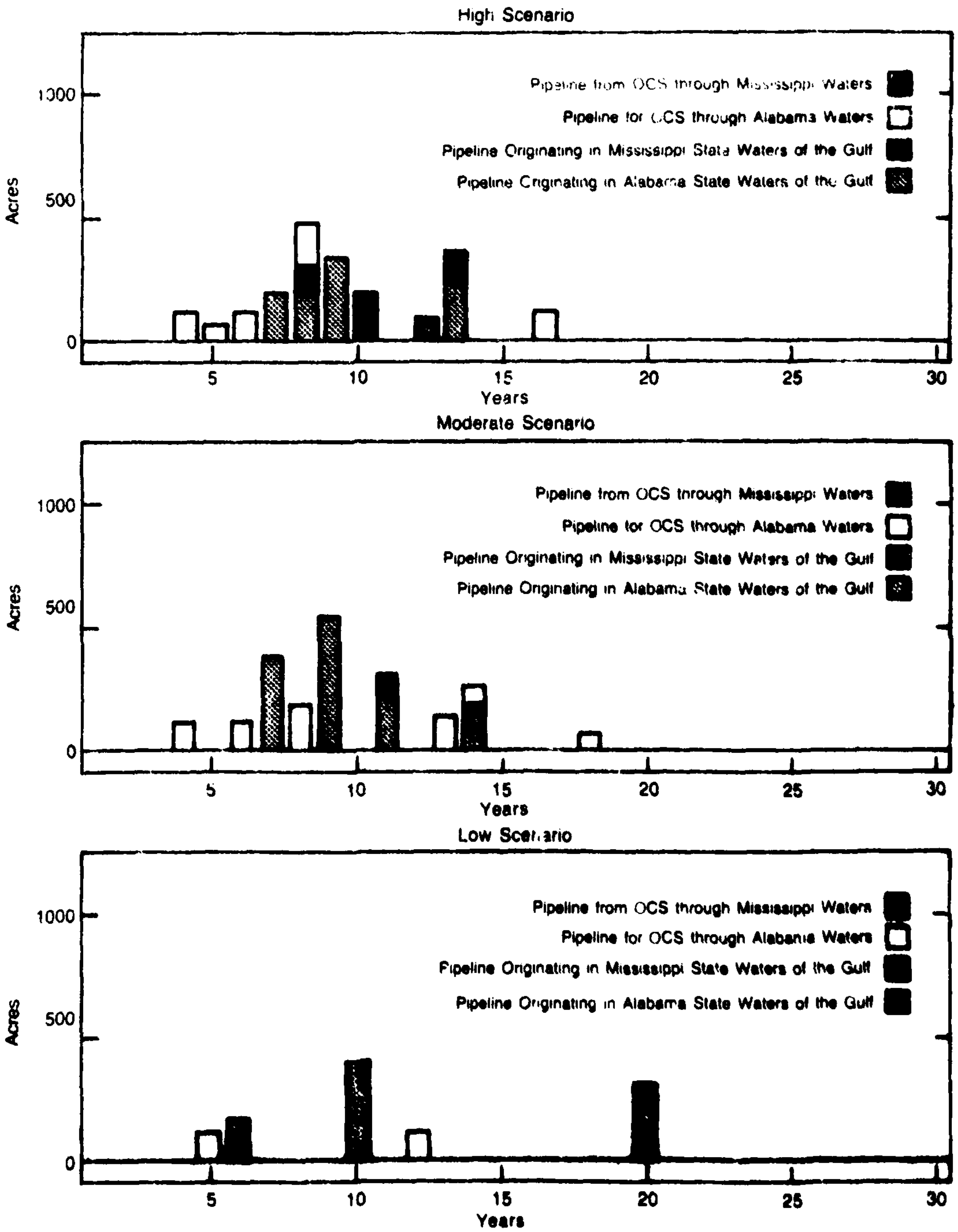


FIGURE 8-14
AREA REQUIRED FOR PIPELINE CORRIDORS IN STATE WATERS OF THE GULF OF MEXICO FOR THE RESOURCE DEVELOPMENT SCENARIOS

Note that there is no activity predicted for the Mississippi state waters under the moderate and low scenarios. All potential ground water impacts would be due to activities in the Alabama state waters of the Gulf. As discussed previously in the Mobile River section, overall chloride contamination potential would probably follow these activity trends.

8.205 Brine production, handling and disposal for these areas should pose less of a potential for groundwater pollution based upon the relatively low volume expected to be produced. Figure 8-15 shows expected brine production for the Alabama and Mississippi state waters of the Gulf based upon criteria discussed previously in the Delta section. As can be noted, expected volumes are low.

8.206 Due to the expected level of activity in the Gulf, the potential for chloride contamination from drilling muds should be less than that described for the Delta region, as would the potential for chloride contamination due to mud disposal.

Impacts Due to Heavy Metals, Chemicals or Hydrocarbons

8.207 Some potential exists for such contamination by way of drilling mud contact with freshwater aquifers during the drilling phase. Due to the expected level of activity, this potential would be less than that discussed for the Mobile River Delta and Mobile Bay subregions. It would be expected that enhancement pollution probabilities will be similar to that discussed for Mobile Bay. Most enhancement activity would be expected either initially or following production decline in about year 14.

Wastewater Disposal

8.208 The total volume of sanitary waste due to hydrocarbon related activities in the Alabama and Mississippi state waters of the Gulf of Mexico is 100 million gallons generated over a 24-year period for the high resource scenario.

8.209 Types of liquid waste produced and wastewater management practice under the moderate resource scenario are the same as for the high resource scenario; quantities will be proportionately less. The total volume of sanitary waste due to hydrocarbon related activities in the Alabama and Mississippi state waters of the Gulf of Mexico is 74 million gallons.

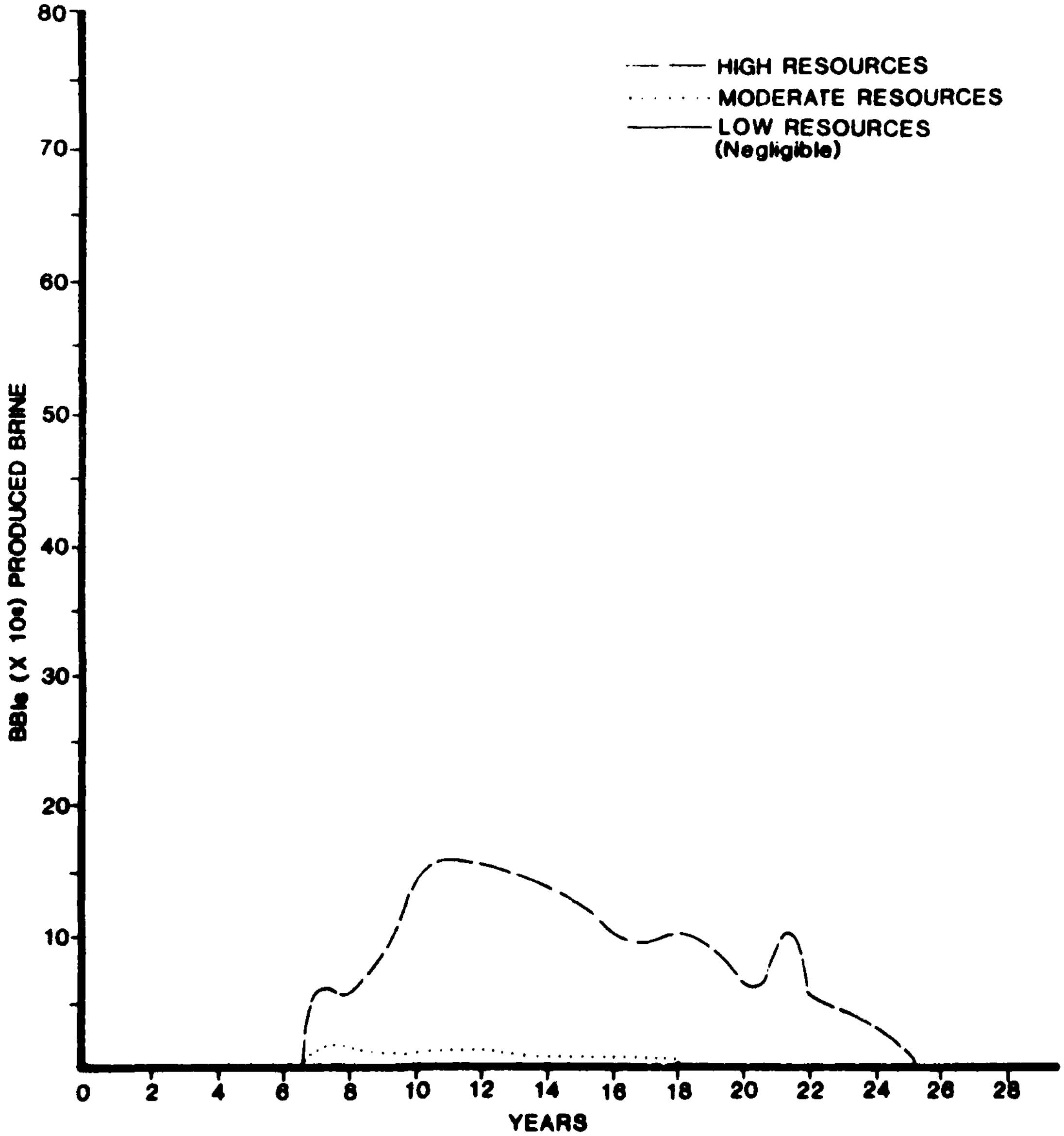


FIGURE 8-15
BRINE PRODUCTION BY RESOURCE CASE
FOR THE STATE WATERS OF THE GULF OF MEXICO

8.210 Types of liquid waste produced and wastewater management practices under the low resource scenario are the same as for the high and moderate resource scenarios; quantities will be proportionately less. The total volume of sanitary waste due to hydrocarbon related activities in the Alabama and Mississippi state waters of the Gulf of Mexico is 60 million gallons.

8.210a The impacts of wastewater on existing wastewater facilities and impacts on the surface waters or groundwater receiving the treated wastes depend upon which wastewater facilities are utilized. The responsible state agency supervises the methods of wastewater disposal and the degree of wastewater treatment available at each facility through the discharge permitting process.

Noise

Noise Generated by Drilling Rig Installation

8.211 The Mississippi portion of Mississippi Sound and the Gulf of Mexico, and the Alabama Gulf of Mexico are assumed to have a general state policy guideline for drilling rigs to be set back one mile from shore (as opposed to one-half mile for Alabama internal waters). This greater distance from rig to shore allows greater noise attenuation compared to Mobile Bay.

8.212 The same noise estimate used for rig installation (L_{eq} = 86 dBA) for internal waters is used for calculations in this section. The value approximating the noise level of basic construction with two attendant vessels is also the same (89 dBA) as assumed earlier.

8.213 Information in Figures 8-4 and 8-5 indicates that under the high scenario in the Alabama Gulf of Mexico there are two to three rigs and in Mississippi waters the number ranges from zero to four rigs. Individual and cumulative drilling rig installation and normal operation noise levels relative to a shoreline receptor a minimum of one mile away is shown in Table 8-17. The maximum number of four rigs are considered in Figure 8-11. The four closest rigs to shore (Rigs 2, 1, 3, 5) are depicted.

Maximum Noise Under the High Resource Scenario

8.214 As indicated by the resource scenario figures, the high resource projection for drilling rigs is four rigs for the Mississippi portion of Mississippi Sound and two rigs for the Mississippi Gulf of Mexico. For Alabama Gulf three rigs at a maximum would be installed.

TABLE 8-17

APPROXIMATE DRILLING RIG CONSTRUCTION AND NORMAL OPERATION NOISE LEVELS ATTENUATED OVER DISTANCE AS PERCEIVED BY AN ONSHORE SENSITIVE RECEPTOR (OFFSHORE MISSISSIPPI GENERAL AND ALABAMA EXTERNAL WATERS)

Number of rigs	Specific rig number (arranged by shortest distance from shore)	Distance from rig to onshore receptor point (feet)	(miles)	Attenuated noise levels: Drilling rig construction noise: Construction only: Indi.	Cumu.	Construction w/2 vessels: Indi.	Cumu.	Drilling rig normal operation: Operation only: Indi.	Cumu.	Operation w/ 3 vessels: Indi.	Cumu.
1	2	5,280	1.00*	44	44	47	47	43	43	47	47
2	1	7,467	1.41	37	45	39	47	36	44	40	48
3	3	7,467	1.41	37	45	39	48	36	44	40	48
4	5	10,560	2.00	27	45	30	48	26	44	30	48

*Assumed distance to shore for Mississippi general and Alabama external waters (also see Figure 3-9).

8.215 Individual and cumulative rig installation noise data presented in Table 8-17 indicate that the closest rig to shore (Rig 2) would produce 44 dBA at the receptor site while all others would produce 37 dBA or less at their respective locations. Cumulative values would be 44 dBA for the closest rig (2) and 45 dBA for one additional rig (1 or 3) or for all four of the closest rigs (2, 1, 3, 5) together.

8.216 If the noise from two vessels is added to basic rig installation noise, the closest rig to shore would contribute 47 dBA at the receptor site. The three closest other rigs (1, 3, 5) would individually produce 39 dBA or less. Cumulative noise data added to the closest rig (Rig 2 at 47 dBA) would remain 47 dBA if the next closest rig (1 or 3) was added and 48 dBA if any other listed additions were made.

8.217 Maximum Noise Under the Moderate Resource Scenario Projection. Maximum noise data for the moderate resource projection during rig installation are also presented in Table 8-17. Relevant rig numbers from the resource scenario figures are four for the Mississippi portion of Mississippi Sound, zero for the Mississippi Gulf of Mexico, and three for the Alabama Gulf of Mexico. Cumulative rig construction noise levels would therefore range from zero for zero rigs to 45 dBA for three or four rigs (48 dBA if two attendant vessels are considered).

8.218 Maximum Noise Under Low Resource Scenario. Individual installation noise data for the two closest rigs (2 and 1 or 3) to shore are listed in Table 8-17. Cumulative noise levels for zero rigs is zero and for two rigs is 45 dBA (basic installation) and 47 dBA (basic installation with two attendant vessels).

8.219 Minimum Noise Under All Resource Scenarios. The minimum noise for all resource projections in Alabama and Mississippi waters is zero.

Noise Generated From Drilling Rig Normal Operations

8.220 As was assumed for the Mobile Bay and adjacent internal waters, the noise level for normal drilling rig operation is 85 decibels at 100 feet. It was assumed that this value did not include attendant vessel noise and that "decibels" were in dBA. Similarly, the value of 89 dBA was again used as a noise level for normal rig operation with three attendant vessels.

8.221 Maximum Noise Under the High Resource Scenario Projection. As indicated in the resource scenario figures, the critical number of active rotary rigs for the high resource projection is four for the Mississippi portion of Mississippi Sound, three for the Alabama Gulf of Mexico, and two for the Mississippi Gulf of Mexico. Based on Table 8-17 data, the individual noise level for normal rig operations for the closest rig to shore (Rig 2) is 43 dBA. All others (Rigs 1, 3, 5) would individually produce 36 dBA or less. The cumulative addition of the closest rig (2) with one or more individual additions (Total of three or four) would be 44 dBA, compared to 43 dBA for Rig 2 alone.

8.222 The addition of three attendant vessels would individually produce 47 dBA for the closest rig (2) or less for the other more distant rigs listed. Cumulative noise emissions for the individual additions of the next closest rigs (1, 3, 5) to the closest rig to shore (Rig 2 at 47 dBA) would be 48 dBA for all cumulative additions.

8.223 Maximum Noise Under the Moderate Resource Scenario. Projection data in the resource scenario figures indicates that four rigs at a maximum could result in the Mississippi portions of Mississippi Sound, three in the Alabama Gulf of Mexico, and zero for the Mississippi Gulf of Mexico. Individual and cumulative noise data are presented in Table 8-17. Cumulative data are 44 dBA for normal operation noise and 48 dBA for normal operation with three attendant vessels for the three or four rigs closest to shore (Rig 2, 1, 3, 5), and zero effect for zero rig operation.

8.224 Maximum Noise Under the Low Resource Scenario. Two active rotary rigs are estimated for the Mississippi portion of Mississippi Sound and the Alabama Gulf of Mexico, and zero rigs for the Mississippi Gulf of Mexico as a maximum in the low resource estimates. Based on the individual and cumulative noise data for normal rig operation the two closest rigs to shore (Rig 2 and 1 or 3) would together produce 44 dBA (48 dBA if three attendant vessels are added). Zero rigs would produce zero noise effects.

8.225 Minimum Noise Under All Resource Scenarios. No rigs are expected to be active during the projected 30-year period for the Mississippi and Alabama Gulf waters. Thus zero noise impact is attributable to normal drilling rig operations.

Noise Generated by Pipeline Construction

8.226 Jetting engines used for marine pipelaying operations, described in the Unit Action, are considerably larger than those used in shallower estuarine systems. Horsepower ratings listed in the Unit Action are 500, 2,200, 2,800 and 4,500. Three or four

engines, as opposed to one, are also employed for marine systems. Based on the larger size (horsepower) and multiple number of engines, it is assumed that noise levels emanating from a marine pipelaying operation are higher than the L_{eq} = 86 dBA at 100 feet used for onshore areas. Bare engine noise for several engines listed in the Unit Action are not as large as those listed for jetting, with the exception of the 500 horsepower D379 (Caterpillar Tractor Company, 1983). Using the 97 dBA for mechanical and 90 dBA for exhaust noise described in the Unit Action as an example, a cumulative level of 98 dBA at 23 feet is obtained. Adjusting this value to 100 feet (~85 dBA) and applying the very approximate correction factor (2 dBA at 100 ft) as done in previous sections, an approximate level of 83 dBA at 100 feet is obtained. The cumulative effect of three pumping engines would therefore be 88 dBA at 100 feet. The use of the larger horsepower engines would produce an even higher noise level estimate. In an attempt to calculate cumulative effects for noise levels greater than L_{eq} = 86 dBA at 100 feet, marine pipelaying noise estimates from 87 to 95 dBA are used.

8.227 Maximum Noise. As described for Mobile Bay and the Alabama portion of Mississippi Sound, the assumed maximum for marine pipelaying would be the simultaneous activities of two operations one mile apart. The attenuation over the one-half mile distance to an equidistant noise receptor would be 56, 57, 58, 59, 60, 61, 62, 63 and 64 dBA for assumed pipelaying noise emissions of 87, 88, 89, 90, 91, 92, 93, 94 and 95 dBA at 100 feet, respectively. For shallower waters in the Mississippi and Alabama Gulf, smaller engines similar to the estuarine operation described previously may be appropriate.

8.228 Minimum Noise. The least noise would be a result of no additional pipelines, thus, no attributable noise elevations.

Threatened and Endangered Species

8.228a Threatened and endangered species in the state waters of the Gulf of Mexico could be affected by collisions with service vessels during routine operations or from spills of liquid hydrocarbons. Infrequent collisions with service vessels of sea turtles or manatees is unlikely to affect regional populations.

8.228b The effect of a spill of hydrocarbon liquids would depend on the size of the spill. Most likely to be affected would be marine birds, sea turtles and whales. A large uncontained spill could have a significant affect on local populations of threatened and endangered birds from direct mortality as a result of oiling or from effects on reproductive success from oiling of eggs from the feathers of adult birds.

8.228c Sea turtles could be affected by direct contact with oil or by ingestion of tar balls after weathering of crude oil. Hatching of eggs could be affected by oiling of beaches with nests.

8.228d Whales occur only rarely in inshore waters and are unlikely to be affected significantly by spills.

Commercial Fisheries

8.229 There are three general categories of potential impacts that the postulated levels of hydrocarbon development could produce: direct loss of fishing area, interference with fishing operations, and space competition between fishing fleet traffic and oil rig traffic. Biological effects of hydrocarbon activities on commercially important stocks have been discussed in other sections.

Loss of Fishing Area

8.230 For the various rig types and the platforms that would be used in the state waters, approximately 3/4 to 1 or 1-1/4 acres would be encompassed by a rig or platform and its adjacent support vessel moorings. The highest removal of acreage would occur when the maximum number of platforms is developed (for each scenario), since the platform area would be removed as potential fishing locations for the 20 year life of the wells. For the low, moderate and high scenarios (3 to 8 platforms), the acreage thus taken in the state waters would range from 2 to 8 acres.

Fishing Vessel Maneuvering

8.231 A second area of potential fisheries impact is the possible conflict between the location of a drilling rig or platform and the maneuvering of a fishing vessel while actively fishing. A fishing vessel towing a net (e.g., an otter trawl) needs a larger maneuvering area while underway then the fishing vessel by itself requires. This is particularly the case when turning. In order to avoid any drilling rig or platform and to give an extra margin of safety since a fishing captain cannot know precisely the location of a net under tow, a drilling rig could generally be fished no closer than 150 to 200 feet (Centaur Associates, Inc., 1981). This would effectively close 4 to 7 acres around a rig or platform to any commercial fishing using towed nets. For the 3 to 8 platforms postulated for the low, moderate and high scenarios, this would produce a total of approximately 10 to 55 acres in which trawling or other fishing operations could be restricted.

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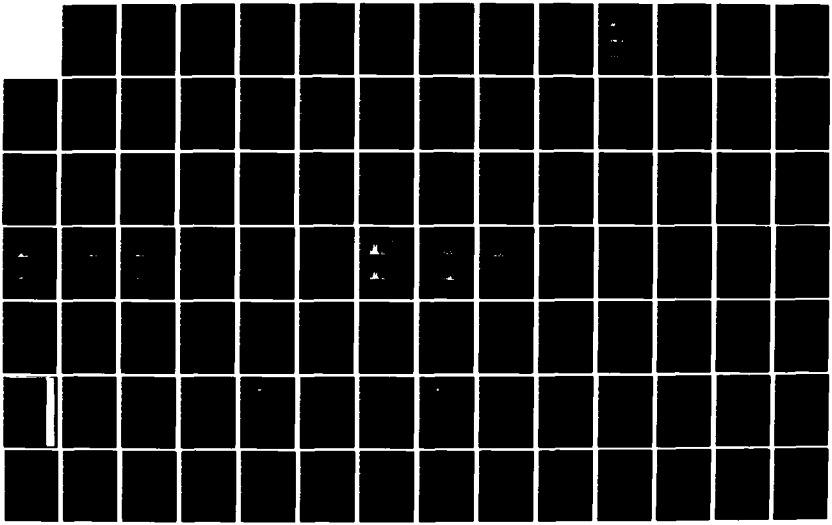
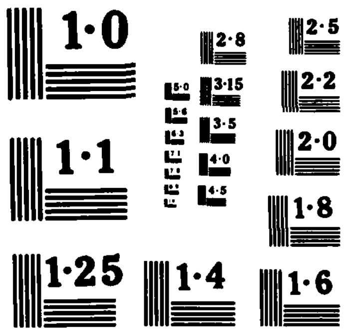




NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

8.232 Another type of potential fishing vessel impact involves purse seining operations. Such operations are used in the Sound in the taking of menhaden. In purse seining, a long net is pulled by a small skiff around a school of fish and then a line at the bottom of the net is pulled, causing the bottom to close or purse. The closed net is pulled in by the larger seine vessel, gradually making the enclosed pond smaller until the fish are alongside the larger vessel where they are loaded into the vessel by dip net or suction pump. While the net is being pulled to encircle the school of fish and as the net is being pursed, the net and seine vessel are susceptible to the winds and current. Encircling a school and pursing a net typically takes about 30 minutes (Centaur Associates, 1981). In wind and current conditions producing a two mile per hour drift, the net and vessel could move one mile before the vessel can maneuver itself and the loaded net. In order to represent the uncertainty in knowing the precise drift direction, an angle of 30 degrees at a rig or platform is assumed which, when combined with the one-mile drift distance, produces a triangular area that would be effectively closed to purse seining operations. Such a triangle would have an area of about one quarter square mile or about 160 acres. Since menhaden, the fish of principal interest in purse seining in the region, form definite schools and are not evenly distributed over the area, the presence of several platforms does not necessarily increase the area of potential closure, but rather increases the probability of such a closure area affecting fishing operations.

Space Competition Between Fishing Vessels and Oil Rig Vessels

8.233 Although the various oil rig vessels would add to the volume of waterway traffic (see Navigation section, below), it is not expected that the rig-related vessel traffic would be of such a level as to interfere with fishing boats going to and from their home ports. Many of the fishing boats leave port in the very early hours before the rig traffic would start and, depending on type of fishing, fishing success and weather conditions, would return at various times throughout the day and night.

8.234 An area of potential conflict could be the competition for dock space between fishing vessels and oil rig vessels. It is not expected that hydrocarbon development companies would need large dock areas since many supplies would be barged from sources in Louisiana (or Texas) and crew transfer points require only a parking lot and a relatively small dock. However, if such companies do develop new dockage areas for staging and crew transfer points, such docks could be of potential use to the fishing industry (or other water-oriented industries) after the oil and gas operations have been terminated.

Cultural Resources

8.235 On previous permits for oil and gas development in the Alabama state waters of the Gulf, the Mobile District has required that a cultural resources survey be performed to identify potential resources prior to any project activities. Following a literature and records search, a multi-sensor survey (including a marine magnetometer and shallow seismic profiler or bottom coring device) of a proposed development location is run to identify any indications of cultural remains. Such surveys are now standard practice in the environmental review of any project. Should the multi-sensor survey identify a potential location of cultural remains, then either additional survey work is required to determine the nature of the potential site or the proposed project activities would be modified to avoid the location.

8.236 Deleted

Navigation

8.237 Based on the data from the resource development scenarios for the Alabama and Mississippi state waters of the Gulf and the federal waters (Figures 8-4, 8-5, and 8-6) and on the assumptions described in Appendix F, the potential daily maximums of waterway traffic increase were calculated for the projected hydrocarbon development activities in the state waters of the Gulf (Table 8-18). This table also includes estimated traffic increases in state waters due to operations in federal waters. Based on the separate scenarios for the two states, the greater part of the traffic would be connected with activities in the Alabama portion of the state waters. The most probable areas for crew transfer points or staging areas would be the areas of Theodore, Bayou La Batre and Pascagoula-Bayou Casotte. Because of this, much of the traffic increases would concentrate on the routes between the drilling/production locations and these staging areas, with the Mobile Bay Entrance Channel, Petit Bois Pass and Horn Island Pass Channel being used to reach the staging areas or the Intracoastal Waterway.

TABLE 8-18

POTENTIAL DAILY MAXIMUMS OF WATERWAY TRAFFIC INCREASE
IN STATE WATERS OF THE GULF

Phase	High Scenario[a] Barge Trips	High Scenario[a] Crew Boat Trips	Moderate Scenario[b] Barge Trips	Moderate Scenario[b] Crew Boat Trips	Low Scenario[a] Barge Trips	Low Scenario[a] Crew Boat Trips
Drilling						
Site Preparation	0	0	0	0	0	0
Routine Operations	8	12	4	6	4	6
Production						
Well Completion	6	18	2	6	4	12
Platform Installation	9	18	0	0	0	0
Normal Operations	0	3	0	2	0	2
Other Traffic						
State Waters Traffic	23	51	6	14	8	20
Traffic from Federal Waters	15	112	10	76	3	19
Totals	38	163	16	90	11	39

[a]Scenario Year 8
[b]Scenario Year 9

Note: Under the Moderate and Low Scenarios, no drilling or production activity is predicted for the Mississippi portion of the state waters.

8.238 In addition to the increases in local waterway traffic, another area of potential navigation impacts involves the establishment of production platforms in the Sound. Such platforms would be permanent structures for the life of the different fields established. Based on the various levels of the resource development scenarios, the number of platforms constructed would range from only 3 to 8. However, regulations and regulated areas have been established to minimize such potential impacts. Specifically, the regulations in 33 CFR 67 provide direction on aids to navigation for fixed structures and these regulations cover general requirements for lights and fog signals, including their arrangement, location and operating characteristics. In addition, safety fairways have been established parallel to designated navigation channels and these fairways provide a minimum separation of one-half between a structure and a navigation channel. (Additional information on the safety fairway system is presented in the Chapter 5 section on the navigation impacts of site preparation activities for well drilling).

<u>Spills and Loss of Well Control</u>

8.239 Oil is only projected to be produced in Alabama state waters of the Gulf of Mexico and only under the high resource scenario. If oil is not produced in Alabama waters of the Gulf, the only crude oil released could be due to a spill from a pipeline that extends from federal offshore waters. Other than natural gas production under the high resource scenario, production is well less than 50 percent of the hydrocarbon production projected to occur in Mobile Bay.

8.240 No hydrocarbon production is projected to occur at all in Mississippi waters of the Gulf, except under the high resource scenario for which natural gas would be produced. The primary types of spills of concern in Mississippi waters are spills from barge traffic and pipelines extending from Federal waters.

8.241 The facts are that Gulf of Mexico waters are free to circulate much more than confined Mobile Bay/Mississippi Sound waters, adjacent shorelines are recreationally and environmentally as valuable as are Mobile Bay/Mississippi Sound shorelines, and hydrocarbon production is not anticipated to be as high in the state controlled Gulf of Mexico as in Mobile Bay/Mississippi Sound waters. The two primary concerns are the pipelines and barges utilizing the project area waters to serve facilities located offshore in Federal waters and the effects spilled oils and chemicals could have on usage of barrier island beaches.

8.242 For open waters of the Gulf of Mexico, unlike sheltered Mobile Bay/Mississippi Sound and Mobile River Delta waters, probabilities of major spills occurring at wells sites have been estimated. From 1953 to 1972, five major accidents occurred per 1,000 successful wells drilled and eight major accidents per 1,000 total wells drilled at rigs or platforms along the Outer Continental Shelf (U.S. Army Corps of Engineers, 1982a). Since 1972, pollution control measures have been more widely implemented, in all likelihood decreasing the probability that a major accident would occur. Other characteristics about past oil spills into Gulf of Mexico waters are presented in Table 8-19. The cause of the largest quantities of spilled oil is the dragging of anchors into pipelines. The Minerals Management Service presents the following additional oil spill characteristics for federal Gulf waters (U.S. Department of the Interior, 1983c):

- 99 percent of oil spills were less than 50 barrels each, 89 percent were less than one barrel.
- 80 percent of total oil spilled is accounted for in four spills, two pipeline leaks from anchor dragging, one fire and one blowout. The most recent of the four spills occurred in 1974.
- Spillage rates for spills larger than 1,000 barrels are decreasing with time; however, pipeline spill rates do not show a statistical decreasing trend. Declines in platform spillage rates are said to be due to:
    - More sophisticated control technology;
    - Voluntary changes in operating philosophy; and
    - Significant increase of inspection intensity.
- Oil production accounts for approximately 90 percent of oil spills from Outer Continental Shelf related activities.

8.243 Because of federal Outer Continental Shelf activities, the probability of one or more oil spills contacting land segments over the production life of a leased tract, based on the Minerals Management Service Oil Spill Risk Analysis, is 51 percent for the Mississippi coastal counties, 26 percent for Mobile County, AL and 25 percent for Baldwin County, AL. The vulnerability rating (from 1 to 5) based equally on risk of spill from Federal activities and the number of exposed environmental resources is 4 for the Mississippi coastal counties and 2 for both Alabama coastal counties; the higher the rating the more vulnerable a courty is considered to be (U.S. Department of the Interior, 1983c).

TABLE 8-19

CAUSES OF OIL SPILLS GREATER THAN 50 BARRELS RESULTING FROM OFFSHORE OPERATIONS ON THE FEDERAL OUTER CONTINENTAL SHELF (OCS) IN THE GULF OF MEXICO SINCE 1964

Causes of Spills	Number of Incidents	Number of Barrels Spilled
Blowouts	9[1]	63,600[1]
Fire	1	30,500
Collisions of Vessels	4	4,330
Hurricanes and Storms[2]	7	14,500[1]
Abandonment Process	1	500
Barge or Marine Vessel Accident	3	7,270
Tank, Separator, Sump Overflow	8	1,010
Transferring Oil, Fuel Operations	7	1,210
Human Error	8	55,300[1]
Equipment Malfunction	12	11,200
Pipeline Leak/Break (unknown cause)	13	14,200
Pipeline Leak/Anchor Dragging	6	192,000
Pipeline Leak/Shrimp Trawl	1	4,000
Pipeline Break/Mud Slide	1	250
	81	399,900

[1] Although the table shows a total of nine blowouts resulting in oil spillage; three could be identified as resulting from other more specific "cause categories." They are: (1) a blowout in 1974 of 75 bbls caused by a hurricane; (2) two blowouts - one the 53,000 bbls Bay Marchand fire of 1970, and another a 200 bbls 1974 blowout, both known as results of human error (the 1974 blowout occurring during repairs of hurricane damage). These are counted more than once on the table.

[2] Two pipeline breaks were caused by hurricanes passing over the project area, spilling 2,310 barrels.

Source: U.S. Department of the Interior, 1983c.

Accidental Release of Natural Gas Containing Hydrogen Sulfide

8.244 In addition to the pipeline connected with development in these state waters, pipelines from development in the federal waters would also cross this area. The probability of an accidental release of natural gas from pipelines was calculated using a pipeline leak detection model (Appendix E). The incident frequencies for pipeline releases in the Alabama and Mississippi State waters of the Gulf, both with and without the federal pipeline segments, are given in Table 8-20.

ENVIRONMENTAL CONSEQUENCES OF ACTIVITIES OCCURRING ON UPLANDS

8.245 Discussed in this section are two categories of scenario effects. One category is the effects of certain facilities that would occur on upland areas adjacent to the study area, such as treatment facilities and pipeline corridors. The other is those effects that have been discussed on a regional basis. These include air quality, solid and hazardous waste, and socioeconomic characteristics.

Upland Ecosystems

8.246 Upland areas adjacent to the Mobile Delta, Mobile Bay and Mississippi Sound would be needed for well sites if directional drilling into these areas is carried out, for oil partial processing plants and gas treatment plants, for pipeline corridors from landfalls to these plants, and/or pipeline corridors from these plants to connections with pipelines to intermediate markets.

Calculation of Area Affected

8.247 Upland area required for pipeline corridors (Figure 8-16) was calculated from pipeline miles on land given in Figures 8-1 through 8-6 and from corridor area per mile given in Chapter 7. Land area required by hydrocarbon treatment facilities has been taken as the midpoint of the range of numbers of plants estimated in the socioeconomic analysis times the average area per plant given in Chapter 7. Only a few upland sites for drilling directionally into adjacent study area wetlands or aquatic systems are likely to be utilized (see unit action chapters). The area of these sites would be small in comparison to pipeline corridors and treatment plants, so this area has not been estimated. No estimate has been made of additional urban land required from ancillary development because the socioeconomic model results indicate that inmigration would occur only under an extremely unlikely worst case condition.

TABLE 8-20

ANNUAL PIPELINE RELEASE INCIDENT FREQUENCY
ALABAMA AND MISSISSIPPI STATE WATERS OF THE GULF

Resource Scenario	Pipeline Mileage	Incident Frequency[a] (in years)
	State Waters Pipelines Only	
High	58	12.5
Moderate	57	12.7
Low	37	19.6
	State Waters With Federal OCS Pipelines	
High	85	8.6
Moderate	84	8.6
Low	43	16.9

[a]Incident - any pipeline release, from the smallest possible leak to a pipeline rupture.

Frequency - the number of years for such an incident to occur.

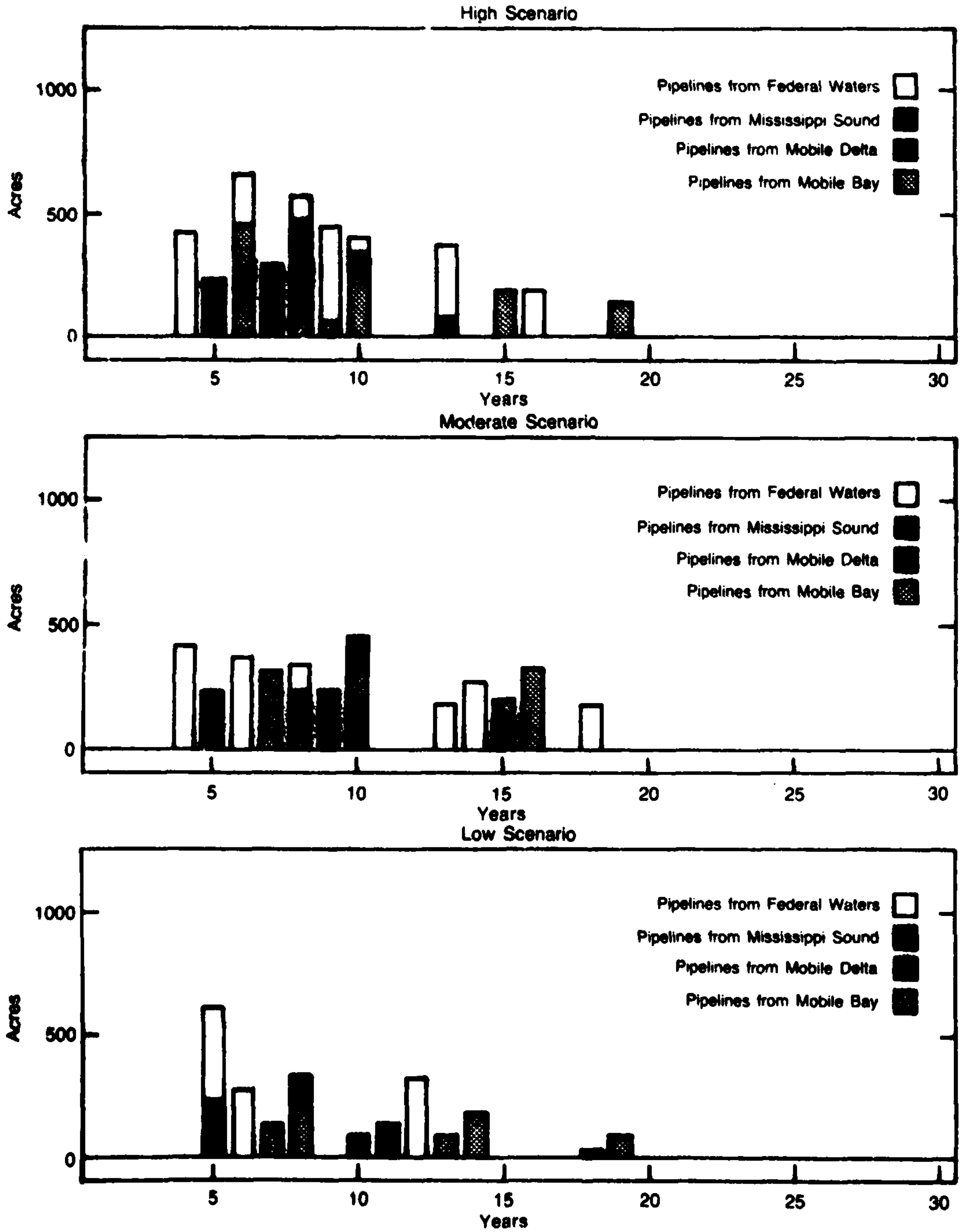


FIGURE 8-16
AREA REQUIRED FOR PIPELINE CORRIDORS ON UPLANDS ADJACENT TO THE MOBILE DELTA, MOBILE BAY AND MISSISSIPPI SOUND FOR THE RESOURCE DEVELOPMENT SCENARIOS

Effects on Upland Areas

8.248 It is likely that most of the upland area affected by pipeline corridors and hydrocarbon treatment plants would be concentrated in southern Mobile and Jackson counties. Some area adjacent to the Mobile Delta would also be affected. The rest of the study region would probably be affected very little or not at all. In general, the land area required for facilities is not large compared to the area available. The study region has also already undergone extensive modification from human activities.

Threatened and Endangered Species

8.249 Effects on some endangered or threatened species could result rom changes in land use. Critical habitat of the Mississippi Sand Hill Crane could be lost in Jackson County since not all of this habitat is owned by the federal government.

Groundwater

8.250 This section summarizes the potential regional impacts to groundwater, particularly in terms of the total brine produced for all subregions for each of the resource development scenarios. The expected overall impact to groundwater resources in the project area cannot be adequately quantified. However, the possibilities for impacts to occur can be expected to vary with the level of exploration, drilling and production activity. The significance of these impacts will vary depending upon location with respect to primary freshwater aquifers. While the probability of groundwater contamination may be low, the long-term local effects of chloride or other chemical contamination to groundwater aquifers if they occurred would be substantial in that aquifer dispersion and removal of pollutants could take up to hundred of years, depending upon particular aquifer characteristics.

8.251 The action having the highest potential for groundwater contamination would be brine disposal. Contamination, if it were to occur, would probably be due to casing rupture of brine injection wells or movement of brine through improperly sealed well holes.

8.252 Estimated total brine production for the project area is shown in Figure 8-17. For all three resource cases, the highest brine production levels will occur between years 7 and 18. These years then would have the highest potential for aquifer contamination, and aquifer monitoring would be most needed. The total estimated brine production for the high, moderate and low resource cases would be 0.9, 1.17, and 2.58 billion gallons, respectively.

8.253 The location of the impact would depend upon where the brine was ultimately injected. Based upon present practice, brine may be disposed of in various parts of Mississippi and Alabama other than the specific geographic area from which it was produced. Adequate storage area will be available for deep well disposal of the produced brine. The Catahoula Formation in Mississippi, at about 3,800 feet, and the Wilcox Formation in Alabama, at about 4,000 feet, are presently used for estimated brine disposal.

8.254 This paragraph has been deleted in the FEIS

8.255 Ultimate disposal of drilling muds could produce a secondary potential impact. This disposal will probably occur in sites remote to this specific project area. Shallow aquifers in the disposal area may be impacted by chlorides, metals, chemicals and possibly hydrocarbons in leachate from the dewatered muds.

Wastewater Disposal

8.256 Surface water discharge of pollutants from hydrocarbon well sites in the study area is prohibited in Alabama and Mississippi. Sanitary wastes, drilling mud liquids, deck drainages and well workover wastes from well sites are stored on-site in barges, holding tanks or lagoons. Sanitary wastes are transported to a municipal wastewater collection-treatment system. Drilling mud liquids, deck drainage and workover wastes are transported off-site and disposed of by deep-well injection. Produced waters are separated from hydrocarbons at the gas processing plant and usually disposed of, along with cooling waters, by deep-well injection. Wastewater disposal should not cause changes to surface water quality, as long as requirements of existing rules and regulations are met.

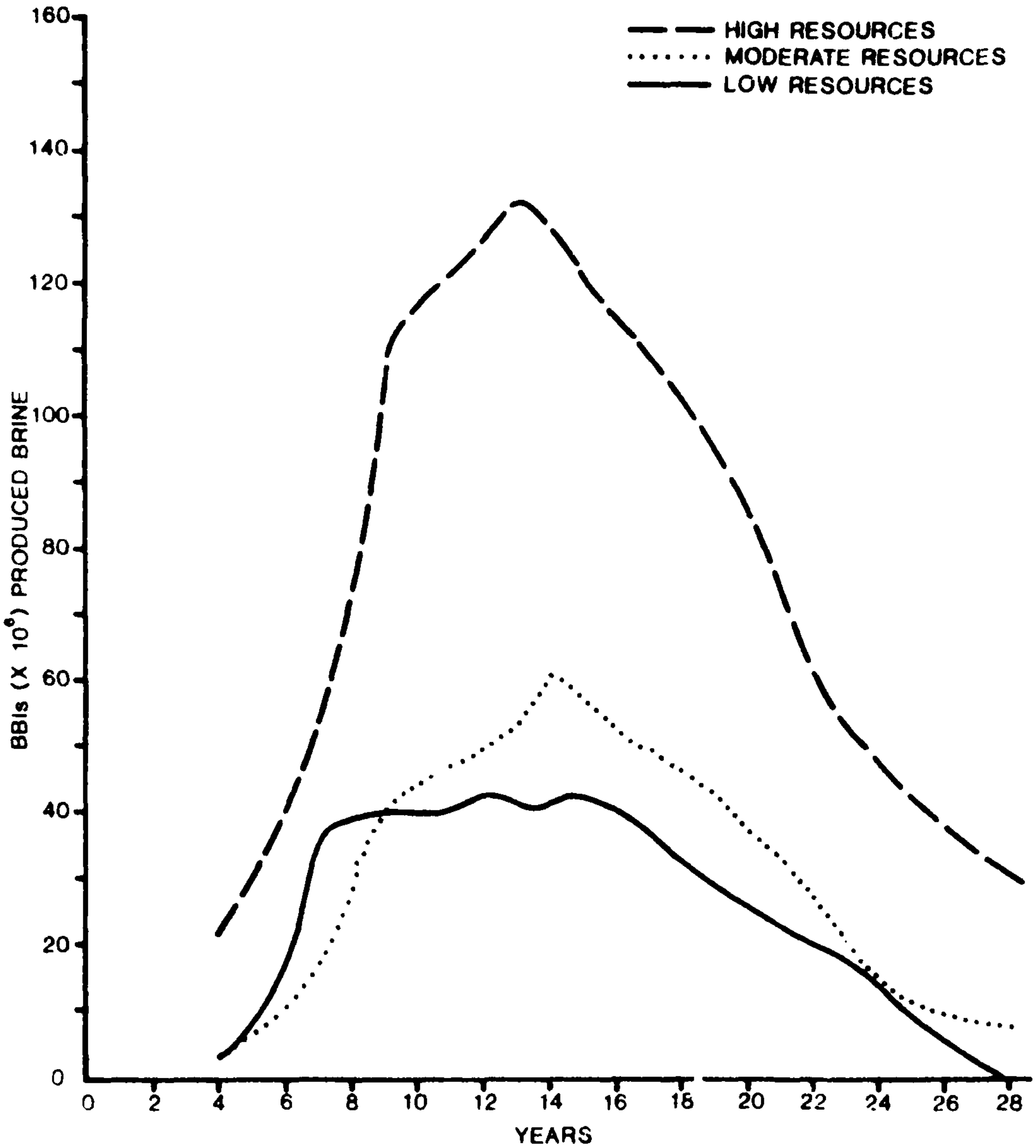


FIGURE 8-17
BRINE PRODUCTION BY RESOURCE CASE
FOR THE TOTAL PROJECT AREA

Air Quality

8.257 The Clean Air Act of 1977 (as amended) was developed to provide reasonable assurance that air quality be either restored to meet ambient or emission standards or maintained through stack or emission controls. Extremely sensitive areas are protected further by the PSD (Prevention of Significant Deterioration) portion of the Act. Any construction, however, will be subject to evaluation of the cognizant state regulatory group even if it does not reach the threshold limits of the PSD regulations.

8.258 It is the purpose of this portion of the scenario assessment to consider the potential cumulative environmental impacts in terms of the Federal, state and local air quality regulations as they apply to the postulated oil and gas source activities. Several portions of the Clean Air Act apply to these activities and will serve to act as either single or multiple constraints on pollution potential in the project area. The first concern in this effort is whether the air pollutant sources emit more than the threshold levels which force the sources to qualify for an air permit before construction and/or operation may be initiated.

8.259 The Clean Air Act defines "de minimis" emission rates which are a basis for consideration as to a source's potential significant impact. In short, if a source is to emit less than these amounts, it may not be of major influence on the large-scale area. A second set of threshold constraints also exist; these are de minimis ground level concentrations. Presumably, if a source would cause ground level concentrations in excess of these, it would also be of possible large-scale area concern. In addition, if the individual source does not qualify for review as a major source, it probably will prove to be of slight concern to this analysis.

8.260 The following scenario assessment is an attempt to determine area sensitivity to rig development and shoreline activity. This is accomplished by comparing resulting ground concentrations with National Ambient Air Quality Standards (NAAQS) and applicable PSD increments. As such, it is conducted on a upper limit basis where individual rigs will require formal permit applications to the cognizant regulatory authorities. Although many PSD concepts are referenced in this section, this scenario analysis is not intended to represent a complete PSD evaluation.

8.261 Appendix E contains a discussion of de minimis emissions standards as they pertain to air pollutants potentially generated from resource production. The screening procedure to determine which pollutants exceed standards and by what level is then described, followed by the results of the screening. The conclusion from the analysis is that rigs do exceed de minimis standards for carbon monoxide (based on an analysis of four rigs) and oxides of nitrogen (Table 8-21) and gas treatment plants exceed them for NOX and SO_2. A BACT analysis and possibly a requirement for ambient monitoring may exist due to these exceedances.

8.262 The potential emissions resulting from both rig and upland gas processing activities postulated in the resource scenarios are considered against the background air quality conditions in and adjacent to the study area. A possible constraint to hydrocarbon development could exist due to SO_2 emission in the western portion of the project region. The Breton National Wildlife Refuge located there is a PSD Class I area. The permissable air pollutant increases for sulfur dioxide and particulate matter in compliance with PSD regulations are shown by Table 8-22. According to Louisiana Air Quality personnel the entire SO_2 increment for the Class I area is committed. This means that no further contribution is allowable. Under these circumstances, a rig proposed within 100 kms of the Class I area would have to consider its impact to that area in detail.

8.263 Table 8-23 indicates how close a single rig could be placed upwind of a Class I area if the total PSD increment were available. The closest distance calculated is about 1.2 km, based on SO_2. If the particulate PSD criteria were used, the spacing could be closer, assuming that the total PSD increment were available.

8.264 The Unit Action Analysis developed emissions as a function of drilling locations (rigs) and all of the support peripherals with the exception of shoreline gas and/or processing facilities. Inclusion of support peripherals (mobile sources) is not required in a PSD permit. It is however included in this evaluation although it represents a very small amount of the total emissions. For these, emissions were postulated per a typical 56 MMSCF/day gas treatment plant. Hence, two items of significance postulated in the resource scenarios are drilling locations established each year and gas processing capacity needed. Oxides of nitrogen and SO2 are the most important degradation pollutants. All modeling presented below is carried out for these pollutants alone.

TABLE 8-21

COMPARISON OF DE MINIMIS AND SINGLE RIG EMISSIONS

Pollutant	De Minimis[a] Emission Levels (tons per year)	Single Rig and Support (tons per year)	Excess of De Minimis Emissions	PSD De Minimis Ambient Concentrations (Clean Air Act) Threshold ($\mu gm/m^3$)
CO	100	168-359	Yes	
HC	--	17	—	
NOX	40	391-410	Yes	14 (Annual)
SO2	40	26-32	Possible	13 (24 hour)
TSP	25	21.7 (Max)	Possible	10 (24 hour)
Ozone (VDC)	40	—	--	
H2S	10	--	--	
TRS (Including H2S)	10	—	—	
Red Sulfur Compounds (Including H2S)	10	--	--	
Each Regulated Pollutant	In Class I areas, within 10 kM of source; emissions 1 g/m^3 in 24 hours.			

[a]Levels of significance for increases in regulated pollutants below which PSD review of non-attaintment area regulations do not apply.

TABLE 8-22

PERMITTED AIR POLLUTANT INCREASES FOR SULFUR DIOXIDE AND TOTAL SUSPENDED PARTICULATES IN PSD AREAS

Pollutant	Averaging Time	Permitted Increases[a]	
		Class I	Class II[b]
Sulfur Dioxide	Annual	2	20
	24-hour	5	91
	3-hour	25	512
Total Suspended Particulates	Annual	5	19
	24-hour	10	37

[a] $\mu gm/m^3$

[b] Mobile and Baldwin Counties are Class I areas.

TABLE 8-23

COMPARISON OF MODELED[a] CONCENTRATIONS TO CLASS I PSD LIMITS FOR TOTAL SUSPENDED PARTICULATES (TSP) AND SULFUR DIOXIDE (SO_2) EMISSIONS FOR A SINGLE DRILL RIG

Pollutant	Averaging Time	Class I Limits ($\mu gm/m^3$)	Distance at Which Limit Occurs from Rig[b]
Sulfur Dioxide	Annual	2	1.6 Km
	24-hour	5	3.0 Km
	3-hour	25	1.4 Km
Total Suspended Particulates	Annual	5	1.2 Km
	24-hour	10	2.2 Km

[a]Modeling technique was after Turner, 1967.
[b]Assumes total PSD Class I increment available.

8.265 In keeping with the upper limit concept, the analysis is made for the worst-year (highest activity) scenario rather than individual years. The others can be derived by the assignment of ratios. No background concentrations are assumed in the modeling because background concentrations vary considerably by area and location.

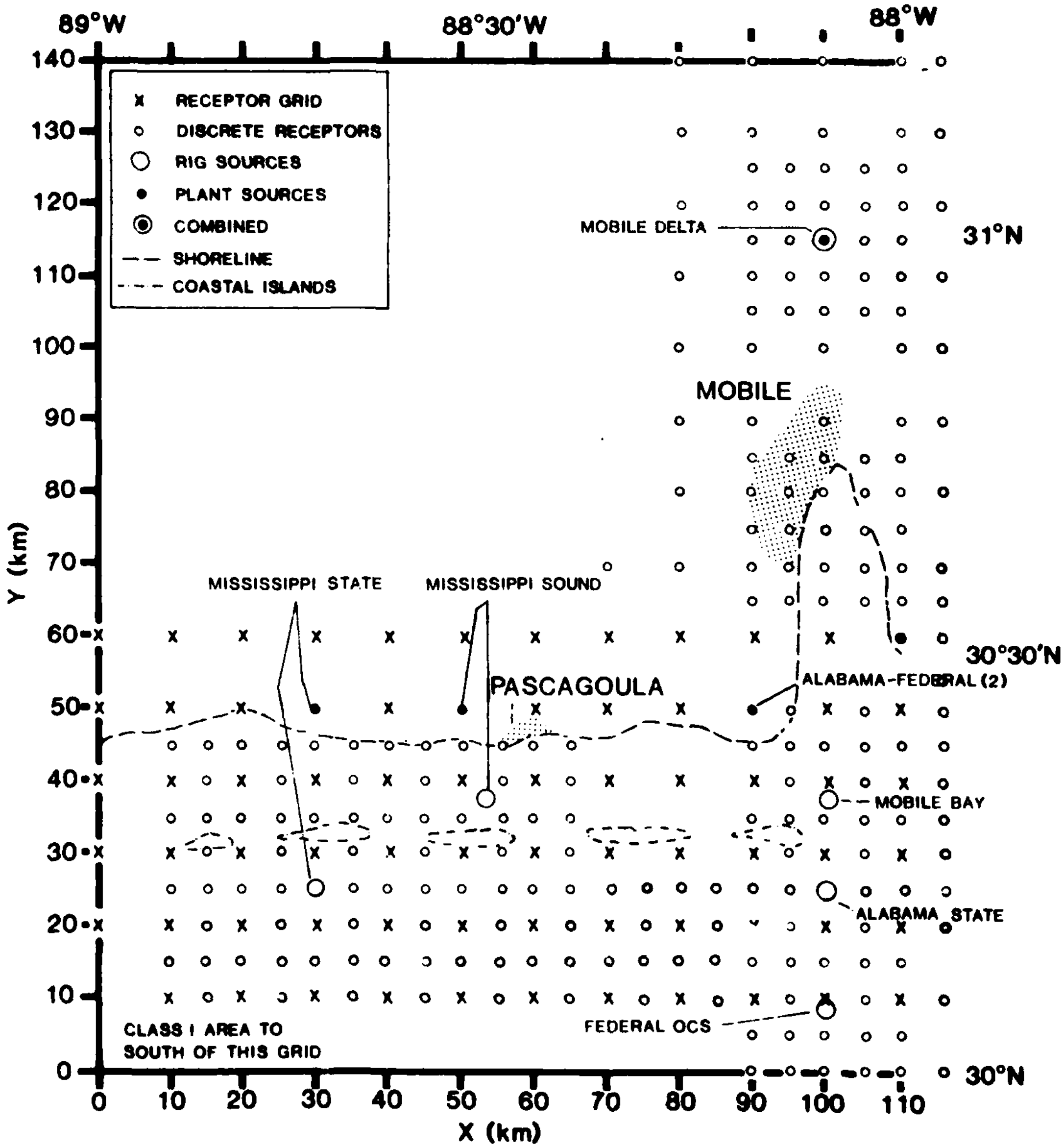
Modeling Considerations and Selection

8.266 Annual concentration modeling was performed using the ISCLT Model. In each case for each area, the modeling emission inputs for maximum activity were assumed to exist at a single point. Figure 8-18 illustrates what was done. Basically a 10 x 10 km grid was set up with 5x5 km sub-grids near each source area. The location of each area major source emission is shown.

8.267 In the modeling, to simplify the source data and technique and also to maximize the impact of the sources, all rigs in each area are assumed to emit from a single point. All treatment plant activity is also assumed to emit from a single point. This maximizes the emissions and made the modeling easier to complete. It also provides maximum impact on the surrounding grid points. A five-year star deck for Mobile, Alabama weather data with six stability classes was used for the years 1972-1977. The actual NOX and SO_2 modeling runs are presented in Appendix E. The ISCLT model was used; annual concentrations are calculated on the grids.

8.268 The Mobile River Delta rigs and gas plant assumed to emit from common point. The Mobile Bay rigs are assumed to emit at one point while a treatment plant is assumed to emit from the closest onshore location northeast of the rigs. Rigs in the Alabama state waters of the Gulf emit from a common grid point in the center of the area and the Federal OCS rigs (high scenario) emit from a common grid point offshore immediately south of the Alabama area. Capacity treatment plants accomodating resources from both areas are assumed to be located to the northwest of the Alabama rig center location as shown. The Mississippi Sound and the Gulf waters of Mississippi were modeled in a similar fashion, with high scenario rig activity emissions and treatment activity emissions assumed.

8.269 Modeling Inputs and Constraints. Certain assumptions regarding stack heights, emission temperatures, and exit velocities are estimated conservatively to enable the modeling exercises to be completed. Mixing heights used were normals for seasonal Mobile, Alabama data, by Pasquill Class. Normal seasoning mixing heights are assumed for each wind and stability class combination. These normals are derived from climatological data readily available for



Note: All Platforms are Located at a Common Point in Each Area; All Treatment Facilities are Located at a Common Point in Each Area. In the Mobile River Delta, the Common Points Were the Same.

FIGURE 8-18
ISCLT MODELING LOCATION ASSUMPTIONS OF ALL SOURCES FOR MAXIMUM OIL AND GAS ACTIVITY IN THE PROJECT AREA

the area. The values used for mixing heights are presented in Appendix E. Ambient temperatures and emission temperatures are assumed to be equal and the emissions are released at a 20-meter height.

8.270 All stack emissions are derived from high scenario emission data per year documented for each area. The computer printout presented in Appendix E provides the source data and assumed locations as shown on Figure 8-18.

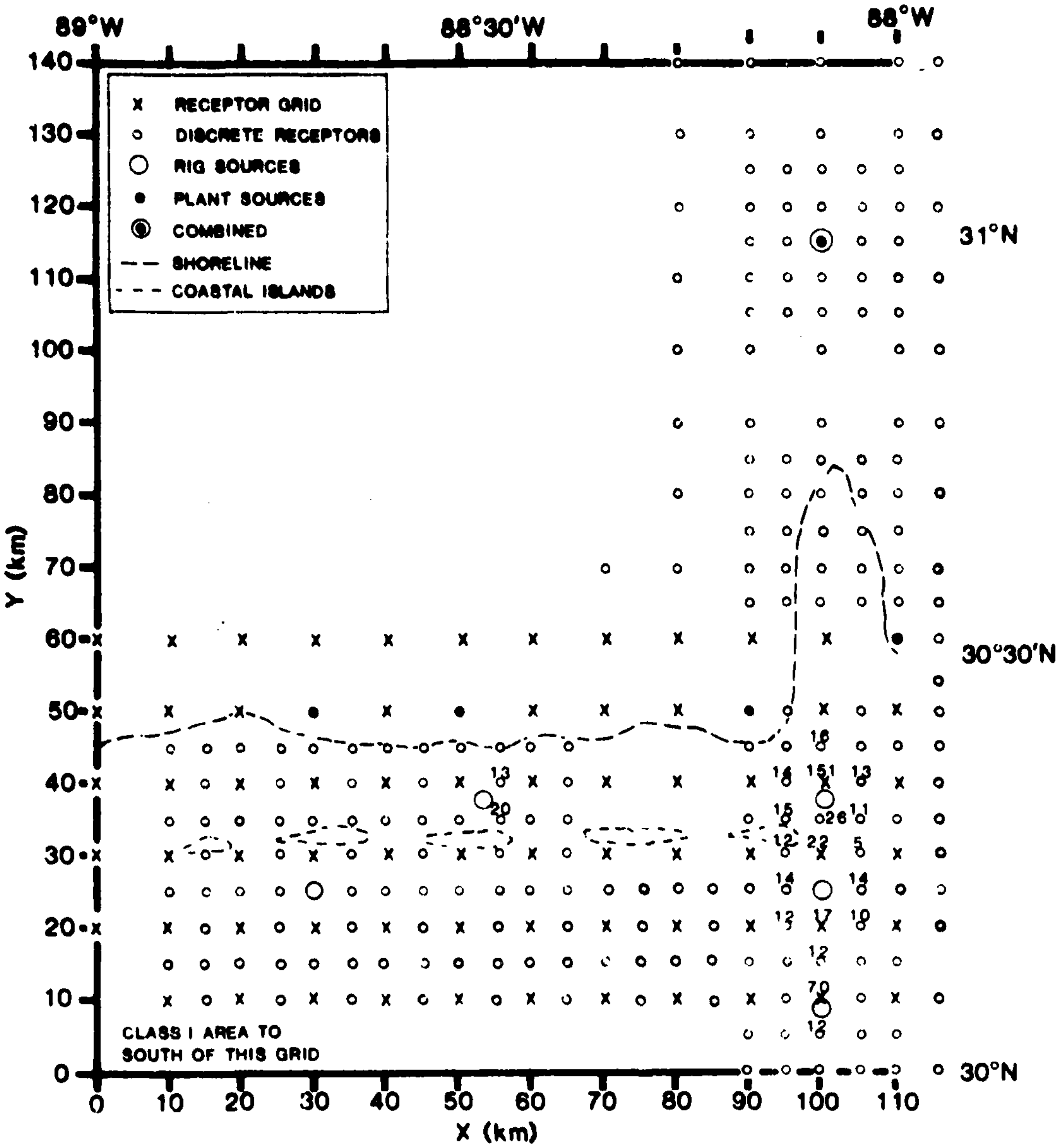
8.271 Modeling Results. The results are plotted on Figures 8-19 and 8-20 for nitrogen oxide (the largest emissions) and sulfur dioxide (the second largest), respectively. Figure 8-19 indicates that there are only 19 grid points where the NOX concentration from the combination high scenario rigs and gas treatment plants equaled or exceeded 10 gm/m^3. This is one-tenth of the annual Federal NOX standard. Appendix E presents the computer printout containing all data points, both greater than and less than 10 gm/m^3.

8.272 Figure 8-20 indicates only five grid points where the SO_2 concentrations from the combination high scenario rigs and gas treatment plants equaled or exceeded the 24-hour Class I PSD limit of 5 gm/^{3}. Further, all concentrations equal to or greater than 1 ugm/m^3 are shown as derived from the ISCLT modeling results. One microgram cubic meter is the "significance" level of sulfur dioxide on an annual basis. The Clean Air Act provides that if a source or sources have 1.0 gm/m^3 impact on the Class I area, then the source need not be concerned about any significant impact on that area. The modeling results clearly indicated that such was the case. In fact, the closest to Breton National Wildlife Refuge that this high scenario combination contributed an annual concentration of 1 gm/m^3 was about 18 to 20 kms. However, any impact to a Class I area would still be added to the baseline inventory of increment consumption.

8.273 Other pollutants were not modeled because it was obvious that their emission levels were well below both the oxides of nitrogen and the sulfur dioxide emissions and therefore would be of no further consequence than indicated above.

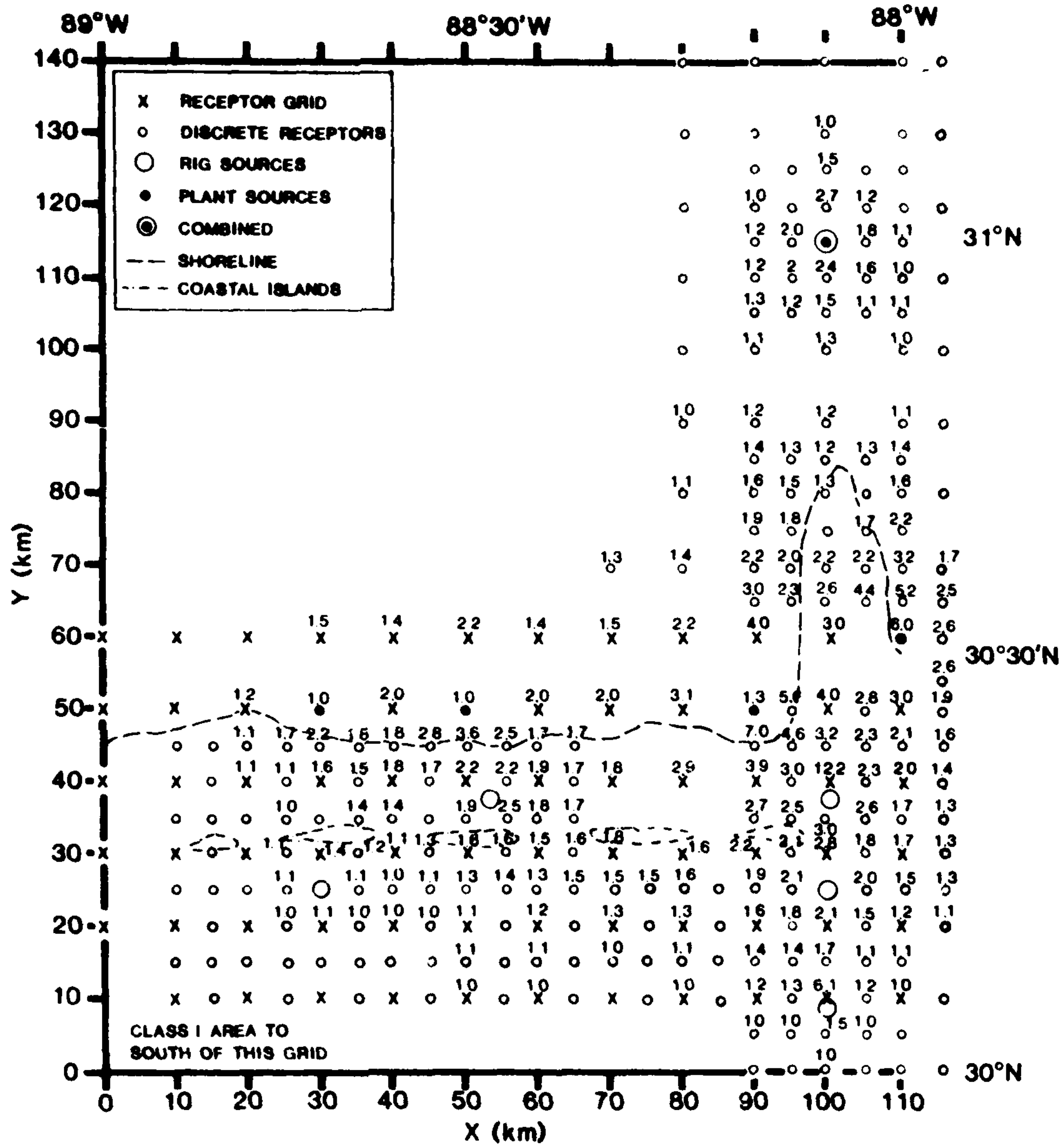
Results of Maximum Emissions Modeling by Geographical Area

8.274 Table 8-24 shows the modeling results for all physical areas in the study region. In this case potential excesses of ambient air quality standards from the oil and gas activity alone are tabulated. The table clearly shows a potential problem with sulfur dioxide concentrations close to the gas processing plants.



*Annual Mobile, Alabama Data
**10% of Federal Ambient NOX Standard

FIGURE 8-19
ANNUAL ISCLT MODELING RESULTS*, NOX HIGH SCENARIO EMISSIONS
(CONCENTRATIONS ≥10 μgm/m³)**



*Annual Mobile, Alabama Data

**Threshold of PSD Annual Significance Levels = 1μgm/m³

FIGURE 8-20
ANNUAL ISCLT MODELING RESULTS*, SO_2
HIGH SCENARIO EMISSIONS
(CONCENTRATIONS ≥ 1μgm/m³)**

TABLE 8-24

SUMMARY OF AIR QUALITY STANDARDS VIOLATED

	High Scenario Activity										
	Single Well Downwind Concentrations					Treatment Plant Downwind Concentrations					Assumed Gas Treatment Facility Capacity (MMSCF/Day)
Table	TSP	SO2	NOX	CO	THC	TSP	SO2	NOX	CO	THC	
Mobile Delta	0	0	0	0	0	0	0	0	0	0	168
Mobile Bay	0	0	0	0	0	0	X	0	0	0	392
Mississippi Sound	0	0	0	0	0	0	X	0	0	0	224
Mississippi State Waters of the Gulf	0	0	0	0	0	0	0	0	0	0	112
Alabama State Waters of the Gulf	0	0	0	0	0	0	X	0	0	0	336
Adjacent Federal OCS Areas	0	0	0	0	0	0	0	0	0	0	672

0 = No standard violated.
X = 24-hour ambient standard violated at point 1 km distant from plant.

8.275 Table 8-25 indicates that potentially nitrogen dioxide and carbon monoxide will be in excess of significant emission limits for rigs and that sulfur dioxide and nitrogen dioxide will likely be above significant emission levels for gas processing plants regardless of the geographical area. Hence, ambient air quality monitoring may be required.

8.276 Table 8-26 indicates that some portion of the PSD regulations will probably apply to all rigs (with their support activities), as this study indicates PSD de minimis concentration levels are exceeded or are close to the thresholds for nitrogen dioxide, sulfur dioxide and occasionally total suspended particulates.

8.277 Table 8-27 indicates that sulfur dioxide downwind concentrations are likely to exceed 50 percent of the PSD Class II concentration limits. This is particularly true for gas processing plants, although there is some indication that it may be of concern with production wells also.

Summary

8.278 Ambient air quality data for offshore areas (1982) obtained from Alabama and Mississippi state agencies responsible for ambient air quality indicated that, on an annual concentration basis, Mobile, Gulfport, Pascagoula and Meridian all indicated ambient concentrations ranging from 18 to 25 percent of the NAAQS Annual Standard for sulfur dioxide (80 gm/m^3). Further, where data was available, about 18 percent of the annual oxides of nitrogen NAAQS (100 gm/m^3) was observed as ambient level.

8.279 The air quality modeling study originally completed by the State of Alabama (ADEM) pointed out that two pollutants might be of concern; these were oxides of nitrogen and sulfur dioxide. That study, however, was limited to Alabama oil and gas activities and did not address the impact from potential on-shore gas treatment plants.

8.280 The ISCLT annual modeling results of the Scenario Assessment indicate a potential concern for both of these pollutant impacts with high resource development scenario activity. The concerns, however, appear to be somewhat lessened after assessing the ISCLT modeling results.

TABLE 8-25

SUMMARY OF SIGNIFICANT EMISSION LOADING ASSESSMENT

	High Scenario Activity										
	Single Well Downwind Concentrations					Treatment Plant Downwind Concentrations					Assumed Gas Treatment Facility Capacity
Table	TSP	SO2	NOX	CO	THC	TSP	SO2	NOX	CO	THC	(MMSCF/Day)
Mobile Delta	0	0	X	X	0	0	X	X	0	0	168
Mobile Bay	0	0	X	X	0	0	X	X	0	0	392
Mississippi Sound	0	0	X	X	0	0	X	X	0	0	224
Mississippi State Waters of the Gulf	0	0	X	X	0	0	X	X	0	0	112
Alabama State Waters of the Gulf	0	0	X	X	0	0	X	X	0	0	336
Adjacent Federal OCS Areas	0	0	X	X	0	0	X	X	0	0	672

X = Above significant level (requires permit).
0 = Below significant level (requires no permit).

TABLE 8-26

SUMMARY OF PSD DE MINIMIS SURVEY

	High Scenario Activity										
	Single Well Downwind Concentrations					Treatment Plant Downwind Concentrations					Assumed Gas Treatment Facility Capacity
Table	TSP	SO2	NOX	CO	THC	TSP	SO2	NOX	CO	THC	(MMSCF/Day)
Mobile Delta	0	X	X	0	0	0	X	0	0	0	168
Mobile Bay	X	X	X	0	0	0	X	X	0	0	392
Mississippi Sound	X	X	X	0	0	0	X	0	0	0	224
Mississippi State Waters of the Gulf	0	X	X	0	0	0	X	0	0	0	112
Alabama State Waters of the Gulf	X	X	X	0	0	0	X	X	0	0	336
Adjacent Federal OCS Areas	X	Close	X	0	0	0	X	0	0	0	672

0 = No limit exceeded.
X = 24-hour limit exceeded at point 1 km distant from plant.

TABLE 8-27

SUMMARY OF GREATER THAN 50 PERCENT CLASS II PSD
24-HOUR INCREMENT CONSUMED
(Minimum Grid Separation 1 Km)

	High Scenario Activity				
	Single Well Downwind Concentrations		Treatment Plant Downwind Concentrations		Assumed Gas Treatment Facility Capacity
Physical Region	TSP	S02[a]	TSP	S02	(MMSCF/Day)
Mobile Delta	0	X(1 km)	0	X (7 km)	168
Mobile Bay	0	X (1 km)	0	X (7 km)	392
Mississippi Sound	0	X (1 km)	0	X (5 km)	224
Mississippi State Waters of the Gulf	0	0	0	X (4 km)	112
Alabama State Waters of the Gulf	0	X (2 km)	0	X (6 km)	336
Adjacent Federal OCS Areas	0 (spacing of clusters 10 km not considered)	0	0	X (4 km)	672

[a]Class II limits: S02 = 91 gm/m^3; TSP = 37 gm/m^3.

0 = Less than 50 percent Class II increment consumed.
X = Greater than 50 percent Class II PSD increment consumed at appropriate distance shown.

8.281 In general, the moderate to low resource development scenarios would produce less ambient burdens than shown in Appendix E. A first approximation would be to assume that moderate activity would produce 75 percent of the highest concentrations and low activity would produce approximately 55 percent of those shown by the modeling results. These results would indicate even less concern over widespread areas.

8.282 The ISCLT annual modeling indicates annual concentrations of oxides of nitrogen to be less than de minimis (of no concern) over a widespread area. At only one grid point receptor was there calculated an excess of the annual Federal ambient standard. The sulfur dioxide modeling results indicate no impact on the Breton National Wildlife Refuge Class I area from maximum oil and gas activity in the project area.

8.283 Ambient air quality appears to be at or about the twenty percent level of NAAQS on an annual standard basis for SO_2 and NOX. The modeling indicates that few grid points experienced this much or more from the total high scenario rig and gas treatment facility assumptions in each area. This would indicate that, overall, the ambient air quality impact of the addition of this activity would be small and, except for a few highly localized areas on special occasions, emissions would be in compliance with NAAQS even when ambient plus these industrial sources are added.

8.284 The high resource development scenario screening modeling assessment for each geographical area indicates the following:

- In order to qualify for air quality acceptability, most if not all drill rigs and processing plants will have to seek air permits in order to comply with state and Federal air laws.
- Even if emissions doubled, there would be no problem complying with the Clean Air Act for the areas between one and three miles offshore.
- Onshore, the local air ambients or attainment status per pollutant may indicate how close a particular emission source and type may locate.

- PSD increment consumption might very well be the most difficult constraint to deal with in the long run. This is particularly true in and near Pascagoula, Mobile, and possibly other urban areas.

- Proximity to other major emission sources could be a concern; normally satisfaction of air quality compliance would have to be resolved in such a situation on a case-by-case basis.

- Short-term (i.e., less than or equal to 24-hour) concentrations will decide ultimate area emission limitations or source locations.

- Impacts on visibility and/or soils, etc. will be minor or insignificant as ambient pollutants will be low in concentration for the most part.

8.285 As a result of this effort to date, the sensitive areas to air impacts from oil and gas development will be those areas which are near or are actually in a non-attainment status, and those areas where greater than 50 percent of the PSD Class II pollutant increments have been consumed or spoken for. The conditions for sensitive areas in each geographical area are:

- Mobile River Delta - In areas close to non-attainment in Mobile County there could be a problem as a result of well and/or processing plant development within 10 km of each other.

- Mobile Bay - In and near Mobile itself where PSD increment consumption may already be high.

- Mississippi Sound - In and near Pascagoula or other urban areas where PSD increments are highly committed already.

- Mississippi State Waters - Only on offshore islands could there possibly be any problem.

- Alabama State Waters - Only on offshore islands might there be any problem.

- Coastal Alabama/Mississippi Federal OCS Area - The limited and expanded modeling indicated that close in, i.e., within a kilometer, there

might possibly be a problem meeting some portion of the Clean Air Act. On an overall basis there should not be any problem.

8.286 The ratio of NOX emmissions over the total area to the THC emissions over the total area from these activities at high resource development scenario levels was:

$$\frac{429.2}{13.64} \text{ or 31 to 1}$$

The analysis has shown that there may be some limited problems with NOX emissions near other sources of this nature. However, it is believed that total hydrocarbon emissions overall will be of small consequence in aggregate as to seriously affect the total hydrocarbon balance in the project area.

8.287 The Breton National Wildlife Refuge Class I location to the southwest of the project area is not likely to encounter any significant air quality impact from the high scenario case, as concentrations determined from modeling show levels less than the significant level.

8.288 H_2S and spills are generally treated as a function of the number of operating rig days or so many incidents per mile of pipeline. Conditions surrounding accidents were discussed in the Unit Action Analysis. Normally, risk to the public can be significantly minimized by separation distances of from 200 m to 1 km from such activities.

Noise

8.289 The most prominent source of hydrocarbon related noise generated in upland areas is associated with treatment plants. The cumulative, as opposed to individual (Unit Action), noise effects of treatment plants would not be clustered. New treatment plants would, however, likely be larger and more frequent in response to increased production, but would probably be spaced reasonable far apart or located in industrial areas with relatively high existing ambient noise levels.

Solid and Hazardous Wastes

8.290 The resource development scenarios and the solid waste volumes described in the Unit Action Analysis form the basis for the solid waste quantity estimates in this section. The resultant waste quantities have been compared to existing and potential capacities of waste receiving facilities to determine the assimilative capacity of the receiving environments. Where the assimilative capacity of

the receiving facility exceeds the high resource scenario and/or a unit action does not generate a hazardous waste or a significant volume of solid waste, the impacts are considered to be minimal. The high resource development scenarios are utilized as worst case conditions in all analyses.

8.291 The Unit Action solid waste impacts discussed in this section focus primarily on offshore drilling activities since these represent the majority of drilling activities potentially occurring in the project area and since the zero discharge practices of offshore drilling activities are widely utilized on adjacent upland sites. As a result, no distinctions are made in the scenario analysis between locational differences except for those facilities (i.e., treatment/processing plants, pipelines) which may require upland locations and for the potential differences in upland and offshore drilling regulations. The discussion below is organized by the activities associated with geophysical exploration, drilling, production and abandonment phases of hydrocarbon resource development.

Geophysical Exploration

8.292 The non-hazardous drilling mud slurry, from geophysical exploration rotary drilling, (100 to 150 gallons per hole) is commonly dumped on the ground upon boring completion. Because most land exploration will be done without muds and because seismic borings and seismic lines are far apart, the volume of solid waste produced from geophysical exploration is minimal.

Drilling

8.293 Site Preparation and Development. Drill site access and preparation in upland areas consists of clearing and grading operations in the Delta, as does board road access and ring levee site preparation. Dredged channels and slips are used for drill rig access in the Delta, in parts of Mobile Bay and Mississippi Sound. Offshore in Mobile Bay, some rigs are fixed in place on prepared shell pads. It is unlikely these procedures will result in solid waste that is disposed of off site. Therefore, there are minimal solid waste impacts from drill site access and preparation activities.

8.294 Routine Drilling Operations. Drilling methods and subsequent mud, fluid, and cutting wastes are determined by subsurface geology rather than by the subregion in which a well is located or the platform and site access option chosen. After permitting, drilling wastes from wells in Federal offshore waters are generally disposed of by in situ dumping and are not considered in quantifying impacts within the project area. Practice to date,

in both marshy and upland areas of the Mobile River Delta has been to collect all wastes (zero discharge) for off site disposal (Workman, 1983). This analysis assumes continuation of this zero discharge practice for all wells in the Delta, in Mobile Bay, Mississippi Sound and state offshore waters. The assumption may provide high side estimates for solid wastes to be disposed of offsite.

8.295 Within the high, moderate and low resource development scenarios are charted numbers of wells started and wells reaching total depth by year. Wells started is the larger number since some wells are never completed. Thus the wells started are used to quantify potential waste production. As indicated in the resource scenario figures, 26 wells will be started in the most active year.

8.296 It is assumed that solid waste consisting of drilling mud and drill cuttings will be landfilled at about 8,200 cubic yards per well using the average of highest reported values (Musson, 1983) as shown in Chapter 4. On this basis, the high resource scenario will require disposal of 1,500,000 cubic yards of mud and cuttings during the 30-year period (rounded up from calculated 1,320,000 cubic yards to allow for contribution from workover rigs). A maximum volume of about 213,000 cubic yards is estimated for the most active year (Figure 8-21). For comparison, the Browning Ferris Industries landfill in Jackson County, Mississippi is now accepting about 480,000 cubic yards per year of compacted garbage and trash (Biggert, 1983).

8.297 Disposal Systems, Inc. of Biloxi, Mississippi estimates that it has on-site capacity to dispose of solids from 230 wells. The inventory of drilling mud/cuttings disposers presented in Chapter 3 includes five Alabama and five Mississippi companies, some of which overlap in use of landfill facilities. Comparison of available disposal capacity to potential volume of produced solids indicates that capacity is available or can be developed by private enterprise to dispose of the anticipated volume of solid drilling wastes. A few additional landfills may be opened for this purpose. These are likely to be located in less urbanized areas of the coastal counties because of competition for space in more developed urbanized areas. A portion of the drilling waste generated in the project area may still be transported to Texas and Louisiana for disposal; conversely, drilling waste from Florida could be brought into the project area. Therefore, the estimated drilling waste volume has not been reduced. Likewise, there has been no reduction made for the possibility that ocean disposal or future alternatives might be permitted in the future.

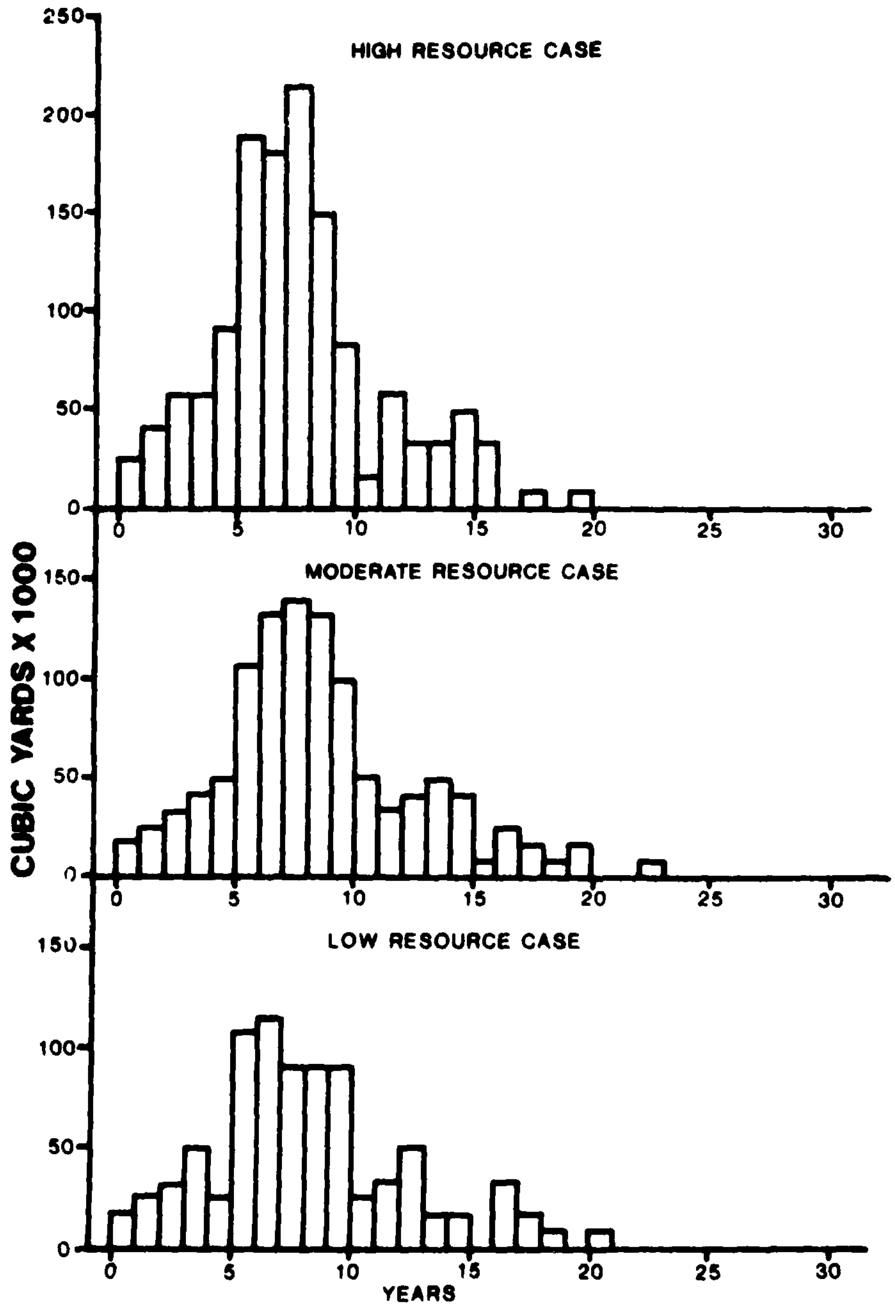


FIGURE 3-21
QUANTITY OF DRILLING MUD AND CUTTINGS DISPOSED OF PER YEAR

Production

8.298 <u>Well Completion</u>. The produced wastes from well completion consist largely of fluids which are either reprocessed for later use or disposed of by deep-well injection. Large volumes of solid waste are not usually produced during well completion; non-hazardous solid wastes removed during this phase are disposed of on shore after separation and reclamation of oils.

8.299 <u>Gathering System Construction</u>. River crossings directionally drilled would require the use of mud and subsequent disposal. The volume, however, would be minimal. None of the other gathering system construction methods described in the Unit Action would result in large volumes of solid waste requiring offsite disposal.

Normal Operation of Wells and Gathering Systems

8.300 Solid wastes volumes produced in normal operations of wells and gathering systems are not considered sufficient to produce major environmental impacts. Accidental releases, accidents and spills associated with these facilities are described as Unit Action impacts because of their infrequent and random history of occurrence.

Well Workover

8.301 The high resource scenario development estimated a maximum of 12 workovers per year. Volumes of workover wastes are typically much smaller (about 2,000 barrels per well) than exploration/production well fluid volume, although the composition may be similar. However, they may contain lower volumes of solids, may even be clear brines rather than barite and clay-bearing fluids, and are frequently reclaimed and reused. An allowance has been added to the solid waste estimate for exploration/production drilling to account for disposed solids from workovers rather than attempting to quantify this volume as a separate impact. The rationale for the allowance is that the solids component of workover rig wastes is the same as for exploration/development well wastes, about 22 percent (Chapter 4; Musson, 1983), that 13 rig years of workover rig work are accomplished at six workovers per rig per year, and that each workover produces 2,000 barrels of fluid and waste. The calculated volume of solid waste is 7,140 cubic yards.

Enhanced Recovery

8.302 Enhanced recovery activities may involve either pumping, gas lift or material injection. The process may even use some natural materials such as waste gases or salt water which might otherwise be considered as possible causes of environmental impacts. The potential for routine production of significant volumes of solid waste is small.

Treatment Facilities Construction

8.303 Construction of treatment facilities involves activities similar to development of other industrial sites in upland areas. Land clearing produces trees, stumps and other biomass which may be reclaimed for boiler fuel, or buried or burned on site depending on local regulations. There is also construction waste and debris which may be placed in landfills. Since many treatment plants are composed of prefabricated units delivered to the site, actual on-site construction will be less than for many like-sized industrial facilities. The maximum proposed construction scenario results in an assumption of five to eight processing plants under construction in one year in the project area or the upland adjacent to it.

8.304 This is a significant amount of construction activity, but not beyond the previous experience of the region. For this type of construction, the solid waste generation is minimal compared to other construction activities in the region.

Normal Operation of Treatment Facilities and Partial Processing Plants

8.305 The waste streams from treatment facilities and partial processing plants are primarily formation and process waters which are disposed of by reinjection as described in other sections of this study. In the study region presently there are well streams derived from the same Jurassic formations expected to be tapped and processing plants to accommodate the existing resources. There is, however, no reported production of hazardous waste on file in Alabama and Mississippi (Brantingham, 1983; Freiberg, 1983).

8.306 Composition of the actual waste streams depends on initial composition of the well stream and the treatment process. To date, only one partial processing facility (Walk, Haydel and Associates, Inc., 1983) and one gas treatment facility (Mobile Oil Exploration and Producing Southeast, Inc., 1981c) have been proposed; the first describes no hazardous waste and the second lists one barrel per day. Since the resources in the project area

are largely unexplored, characterization of waste streams is uncertain. However, the expectation is that oils will be light with little if any production of hazardous sludges or other wastes (Hickok, 1983).

8.307 Partial Processing Plants. The high resource development scenario assumes maximum production of about 30,000,000 barrels per year (82,000 barrels/day) of oil and natural gas liquids, enough to require about nine plants like that presently proposed by Superior Oil Company. The currently proposed plant is unlikely to produce any hazardous wastes (Walk, Haydel and Associates, Inc., 1983). Other nearby plants typically use physical processes which produce no chemical sludges; however, a limited amount of trash and non-hazardous waste is generated. Infrequent periodic cleanouts of tanks and piping result in limited volumes of sludge which may be reclaimed, incinerated, possibly land farmed, or sent to a hazardous waste facility depending on the volume and composition.

8.308 A related industry presently operating near the project area, reported 37 tons of bottom sediments and hazardous waste in 1980. This is considered a modest amount readily disposable by existing hazardous waste facilities.

8.309 Gas Treatment Plants. The high resource scenario assumes maximum production of about 130 billion cubic feet per year (360,000,000 cubic feet per day) of natural gas. A presently proposed 225 MMSCFD sour gas processing plant (Mobil Oil Exploration and Producing Southeast, 1981b) is estimated to produce one barrel per day of semisolid hazardous waste. On the same basis, less than two barrels per day of hazardous waste would be produced by the estimated high scenario production. Such volumes could be readily handled and accepted by presently operating hazardous waste facilities. The Chemical Waste Management facility in Emelle, Alabama is the only present interim status commercial facility in Alabama and Mississippi. Some of the produced gas from the project area may contain little hydrogen sulfide. Therefore, the above "less than two barrels per day" hazardous waste estimate may be high since it was derived by extrapolation of data from a "sour gas" treatment plant. Sweet gas (little or no hydrogen sulfide) produces no appreciable amount of hazardous waste.

8.310 A few tons per year of incidental solid wastes result from gas treatment plant operations. Most of these wastes are disposed of by routine methods; a fraction, such as oil filters, may be classified as hazardous if present in sufficient quantity. To date, gas treatment plants operating in or near coastal counties of Alabama have reported no hazardous waste generation under Federal reporting requirements.

Transport of Resource to Intermediate Market

8.311 Pipelines, barges, rail cars or over-the-road trucks are used for product transport. Pipeline construction solid waste impacts are similar to those of gathering system construction and are minimal. Normal operation of transport systems produces virtually no solid or hazardous wastes except for possible accidents and spills.

Service Bases

8.312 Present trends and practices indicate that permanent service bases in Louisiana will be used for oil and gas exploration and development in the project area. Some temporary facilities would likely be leased from local dock and harbor facility operators and mud companies. Construction of additional local scaled down service bases would be similar to other waterfront dock and supply facilities producing only construction debris.

8.313 Solid wastes from service base operations include dunnage from unloading and uncrating, garbage and refuse from supply and crew boats, and garbage and waste from service base employees. These limited quantities could be disposed of by municipal or contract solid waste disposal services depending on the location.

Abandonment

8.314 When the commercial potential of an oil or gas field is exhausted, production processing and transportation activities are terminated. Well site abandonment produces some salvageable and salable scrap metals and a volume of usual construction materials, equipment and debris. Pipelines are generally emptied, plugged, and abandoned in place producing little solid waste.

8.315 Removal at upland processing and treatment facilities includes removal of surface equipment and flowlines and vessels for reuse or resale, if possible. Unusable metal equipment and vessels are sold for scrap. Foundations and floor slabs may be left in place. Solid wastes include a volume of unsalvageable construction materials and debris and sediment and residues from treatment vessels. In some cases unsalvageable materials can be buried or burned on site. Residues may also be burned on site subject to regulations for construction and management of burning pits and air pollution controls. Tank and vessel residues may require disposal as hazardous waste, but probably would not greatly exceed residue volumes associated with periodic cleanings. Such volumes of hazardous waste can be disposed of at available hazardous waste facilities. Any gas and oil facility permitted to store, treat, or dispose of hazardous wastes would be required to close its hazardous

waste units in accordance with the conditions of the facility's RCRA permits. Abandonment of service bases and intermediate transport facilities would be similar to activities for production and treatment facilities and gathering systems.

8.316 It is reasonable to assume that facility abandonment would occur gradually, during which the available disposal capacity of the region could accept solid and hazardous wastes without significant adverse impact or dislocation.

Cultural Resources

8.317 Dependent on regulatory requirements for major development activities in uplands (drilling, gathering line installation, oil or gas processing plant construction), a cultural resources survey may be required to identify potential resources prior to any project activities. Following a literature and records search, a determination is made as to whether a field reconnaissance is required in the project area.

8.318 If evidence of cultural resources is found during the survey, an intensive field survey would be performed to delineate the extent of the remains in relation to those areas that could be disturbed by proposed project activities. Prior to the issuing of any permit, any conflicts regarding the potential impacts to cultural resources due to project activities must be resolved.

8.319 However, one area of uplands development could potentially affect cultural resources of the region. This is the area of secondary or ancillary development and would include such activities as upgrading or establishing a service base or service company supply area and upgrading or building access roads leading to service or supply bases or to treatment facilities. Such activities would include elements that could potentially affect cultural resources in the area of development. Although many of these activities would be covered by federal or state requirements for a cultural resources survey prior to starting development, some activities would not and would, therefore, have a potential for affecting cultural resources that might be in the area of development. Although the potential for such impacts is dependant on the specific site of the development and is not quantifiable, it would be expected that secondary or ancillary development associated with the high resource development scenario would have the higher [illegible] including activities that could affect potential [illegible] areas of the region.

Socioeconomic Characteristics

8.320 The principal characteristics of the local socioeconomic environment that could be influenced by hydrocarbon development offshore Alabama and Mississippi are employment, state and local government revenues, and local land use. Based on the regional resource scenarios the potential employment generated by the offshore activity is determined in this section. The estimates serve as input for an Economic Impact Assessment Model which projects the level of impact, if any, within the coastal counties of Alabama and Mississippi as a result of employment increases. Estimated state revenues are also presented for the resources in state territory and the amount of land necessary for processing facilities is determined.

8.321 Added employment in an area can be the driving force behind potential effects on a local community. Employment estimates can be used to ascertain if in-migration is needed to fill available employment positions and if added public funds are required to accommodate a growing population. The nature of the potential employment, whether short term construction or long range operations bears on the magnitude of possible effects, and thus the ability of a community to respond. These and other factors are considered in the employment estimates given below which become the driving force behind the impact assessment model. The assumptions on which the estimates are based and the manner in which they are derived for occupations involved in offshore resource development are detailed in Appendix F.

8.322 This section first contains a summary of the assumptions made underlying the employment estimates. A description of the Economic Impact Assessment Model used to determine potential effects resulting from the added employment in the area is then summarized. The results of the model runs follow the summary. Assumptions made to determine revenues and land use estimates for the coastal states follow the sections on employment. Activity offshore both coastal states and in the adjacent federal waters are considered.

Employment

8.323 To determine the level of employment and potential effects from it in the study area, a number of assumptions are made. A summary is included below; details are described in Appendix F.

8.324 Area Affected by Concurrent Activities. Unlike the local physical environment which is divided by natural features the socioeconomic environment, for analysis, is divided into two onshore areas. The first region includes Mobile and Baldwin counties in

Alabama, and Jackson County Mississippi from Pascagoula east to the Alabama State line. The second area is composed of Hancock and Harrison counties, Mississippi.

8.325 The level of hydrocarbon resources and their development described in the scenarios dictates the location of activity, thus the location of labor requirements. Maximum employment would result from all concurrent activities related to development in the Mobile Delta, Mobile Bay, the Mississippi Sound, the Gulf waters within state territory and in the adjacent federal waters.

8.326 The physical regions listed above are divided into two areas for socioeconomic analysis, because the geography of development would mostly draw upon the two area labor pools defined for analysis.

8.327 <u>Employment by Area and Scenario</u>. Total potential employment for the high, moderate and low scenarios is depicted in 18 bar charts (Figures 8-22 to 8-30). The figures are grouped into the three following sets.

- Set 1 - Employment generated by activity in the Mobile Delta, Bay, eastern Mississippi Sound and Gulf of Mexico waters in Alabama state territory (Figures 8-22, 8-23, 8-24);
- Set 2 - Employment generated by activity in the central and western Mississippi Sound, and the Gulf waters in Mississippi state territory (Figures 8-25, 8-26, 8-27); and
- Set 3 - Employment generated by activity on the adjacent federal OCS (Figures 8-28, 8-29, 8-30).

[illegible] three sets there are six bar charts. Two of the [illegible] depict potential employment resulting from the high [illegible] represent the moderate scenario, [illegible] the low resource estimates. The two bar chart[illegible] represent the high and low estimates of the range [illegible] employment.

[illegible] There is a distinction made on all the bar charts [illegible] total potential employment from activities which could draw upon the local labor pools, and occupations which would offer little if any opportunity for local involvement. The first category includes activities such as site preparation for rigs, service base maintenance and gas processing plant construction. Gas processing plant construction is exhibited as a separate block within the annual total because it is the major activity which could involve local employment. The second category on each figure represents the labor required for all self contained operations such as rig and

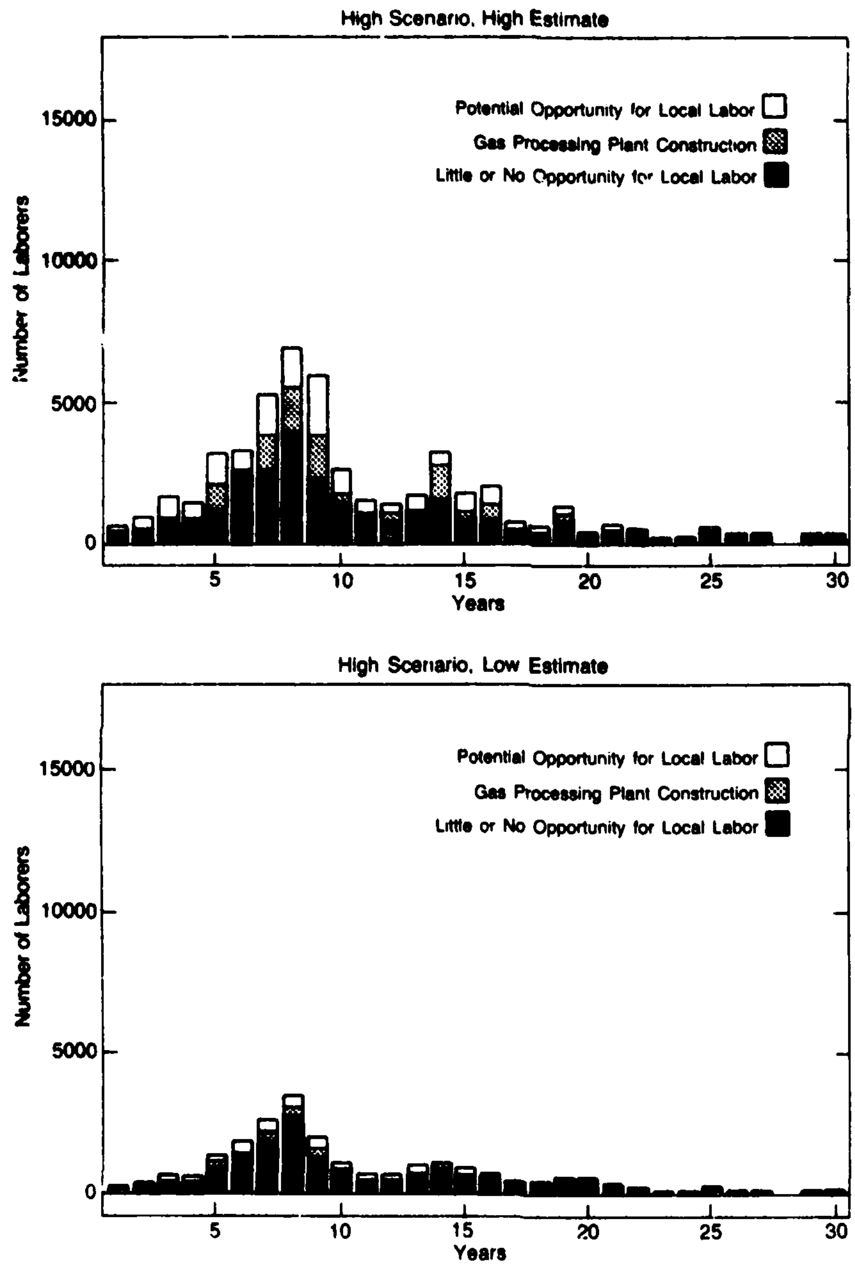
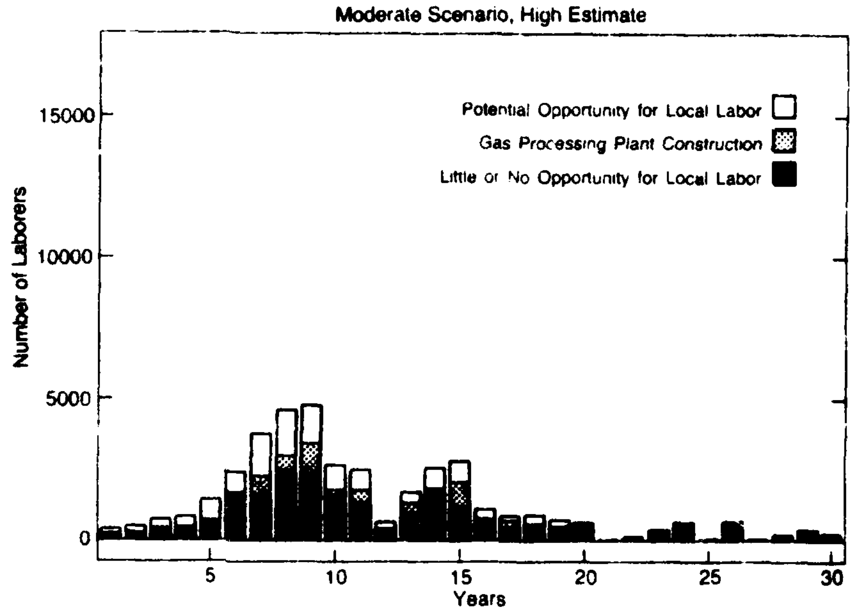


FIGURE 8-22
DIRECT LABOR REQUIRED FOR ACTIVITIES
IN THE MOBILE DELTA, MOBILE BAY, EASTERN MISSISSIPPI SOUND
AND ALABAMA GULF OF MEXICO UNDER THE HIGH RESOURCE SCENARIO



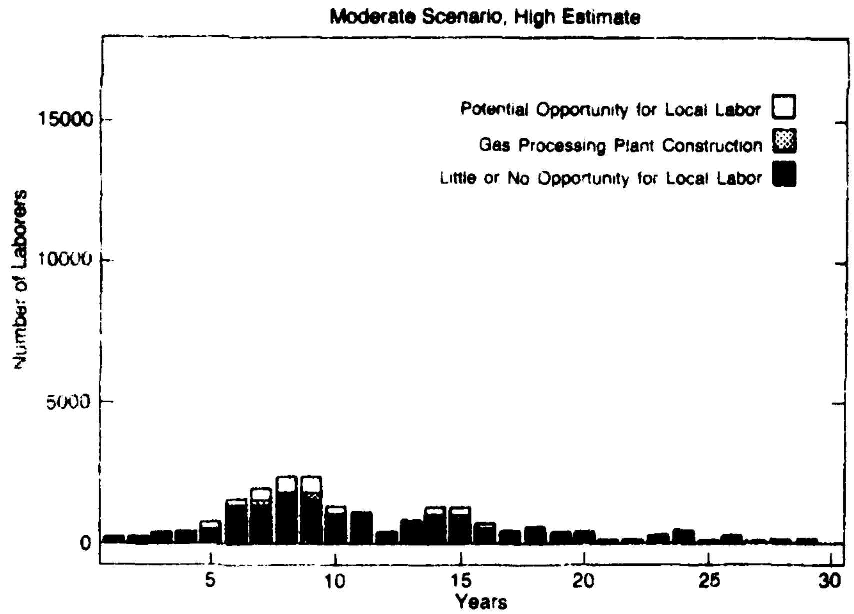


FIGURE 8-23
ESTIMATES OF DIRECT LABOR REQUIRED FOR ACTIVITIES IN THE MOBILE DELTA, MOBILE BAY, EASTERN MISSISSIPPI SOUND AND ALABAMA GULF OF MEXICO UNDER THE MODERATE SCENARIO

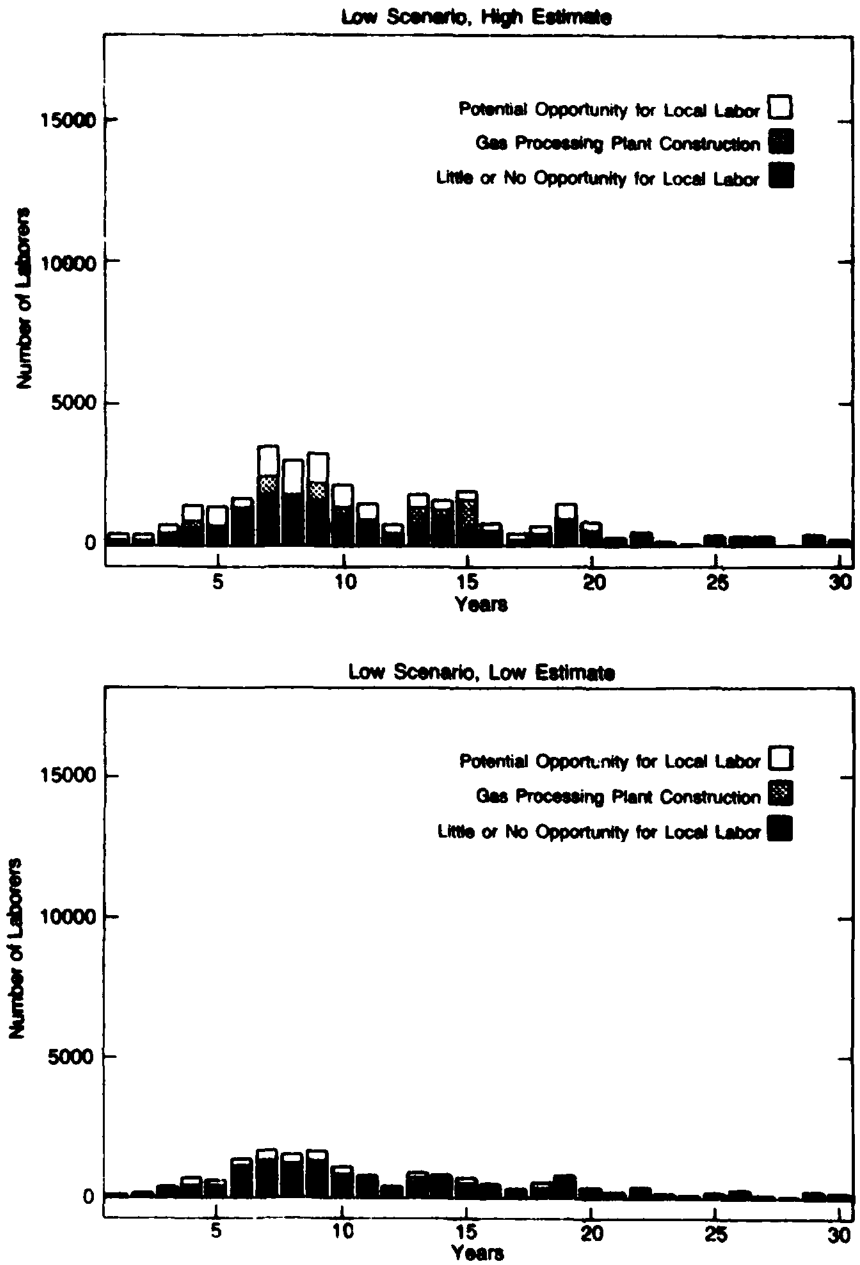
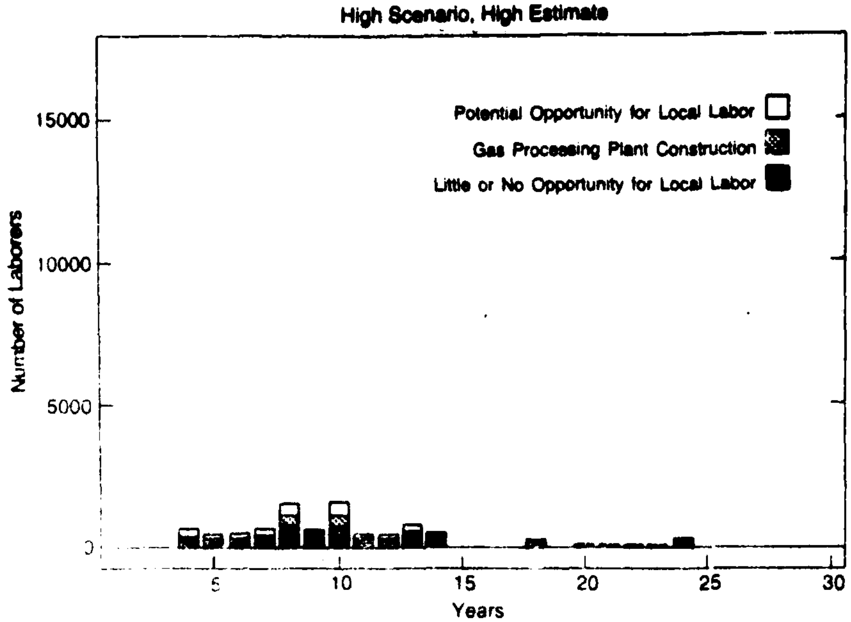


FIGURE 8-24
ESTIMATES OF DIRECT LABOR REQUIRED FOR ACTIVITIES IN THE MOBILE DELTA, MOBILE BAY, EASTERN MISSISSIPPI SOUND AND ALABAMA GULF OF MEXICO UNDER THE LOW SCENARIO



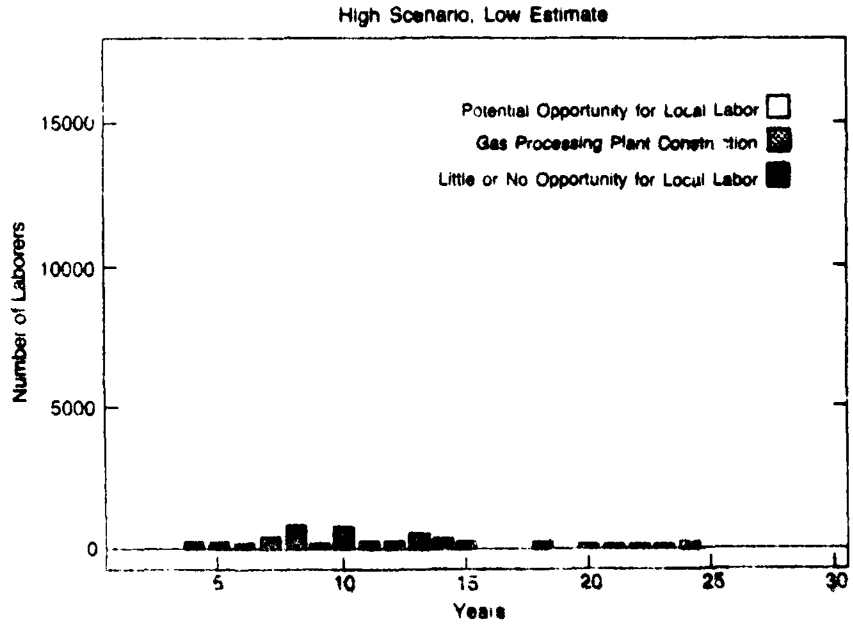


FIGURE 3-25
ESTIMATES OF DIRECT LABOR REQUIRED FOR ACTIVITIES IN MISSISSIPPI STATE WATERS OF MISSISSIPPI SOUND AND THE GULF OF MEXICO UNDER THE HIGH SCENARIO

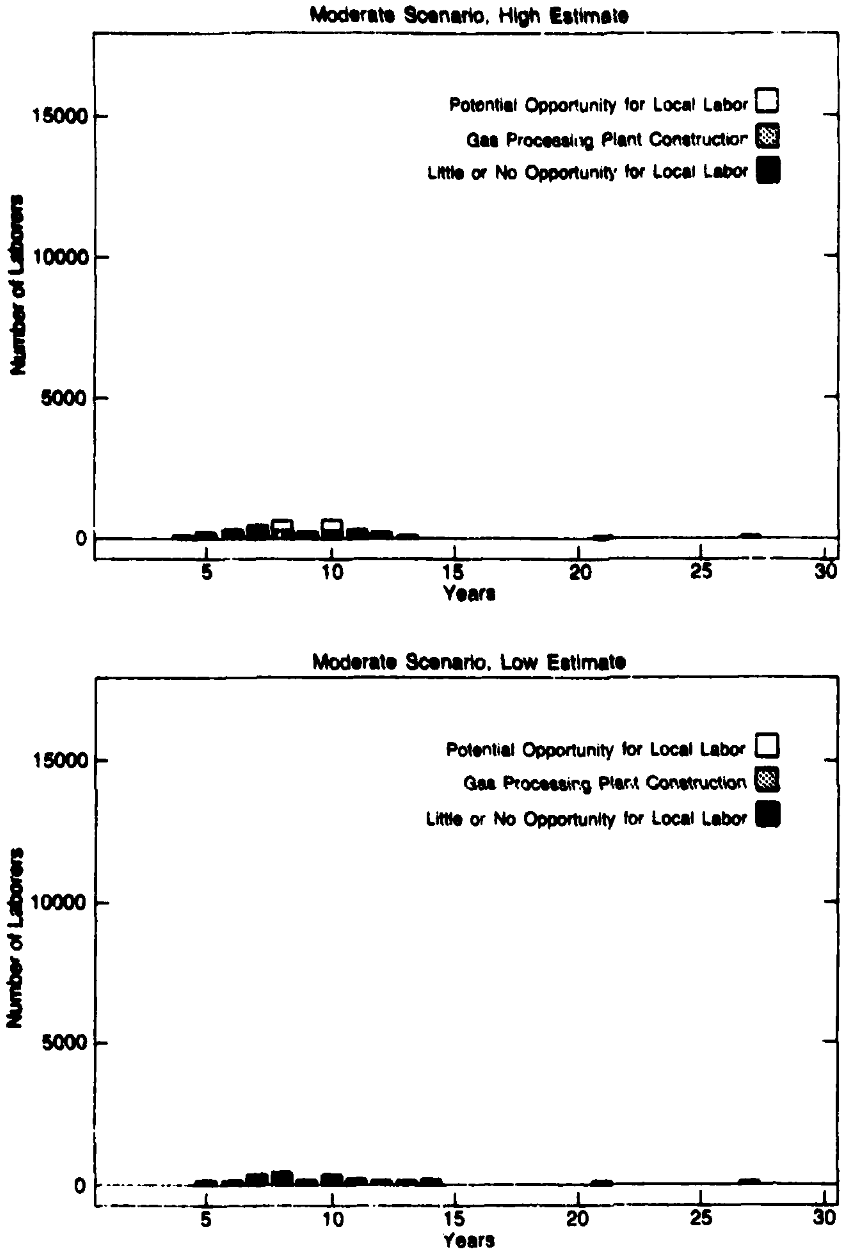
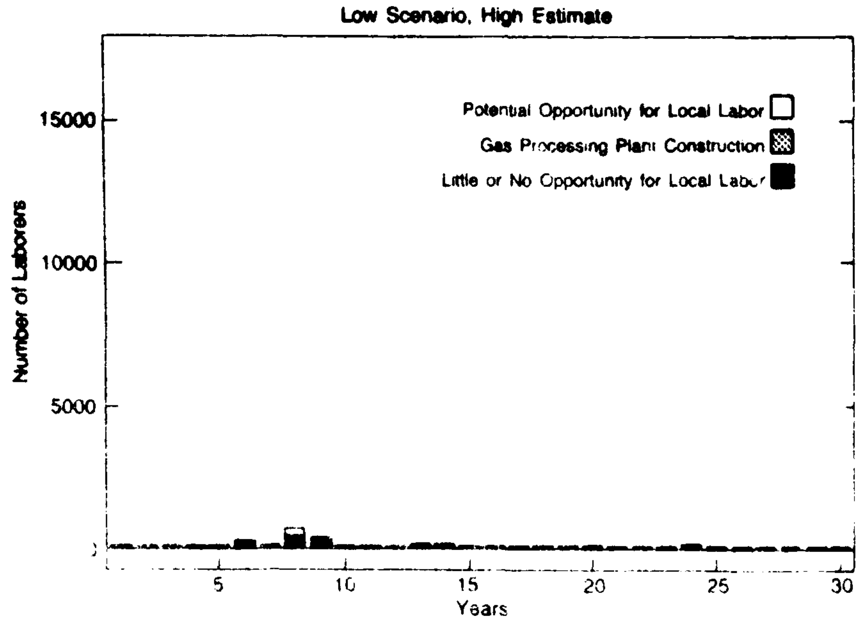


FIGURE 8-26
ESTIMATES OF DIRECT LABOR REQUIRED FOR ACTIVITIES IN MISSISSIPPI STATE WATERS OF MISSISSIPPI SOUND AND THE GULF OF MEXICO UNDER THE MODERATE SCENARIO



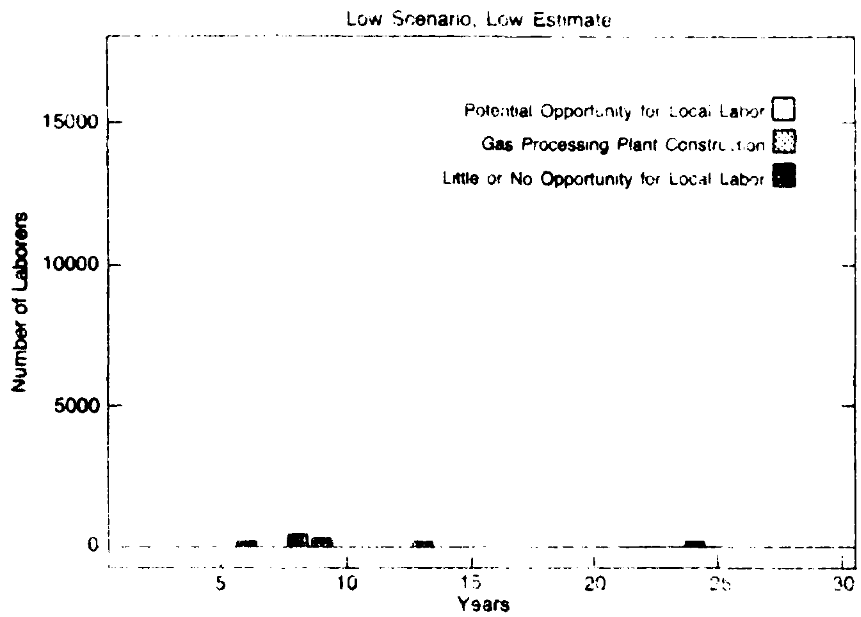
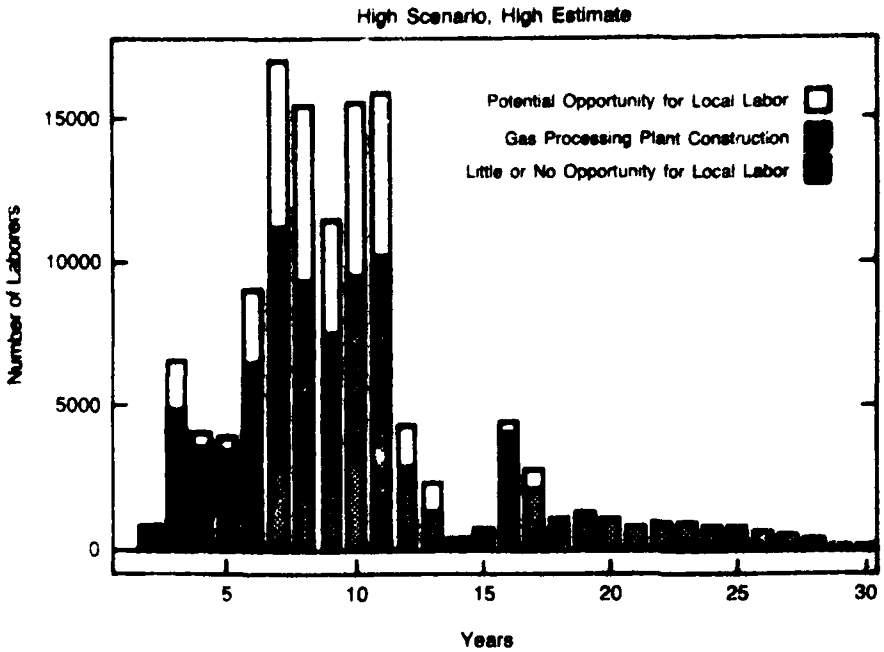


FIGURE 8-27
ESTIMATES OF DIRECT LABOR REQUIRED FOR ACTIVITIES IN MISSISSIPPI STATE WATERS OF MISSISSIPPI SOUND AND THE GULF OF MEXICO UNDER THE LOW SCENARIO



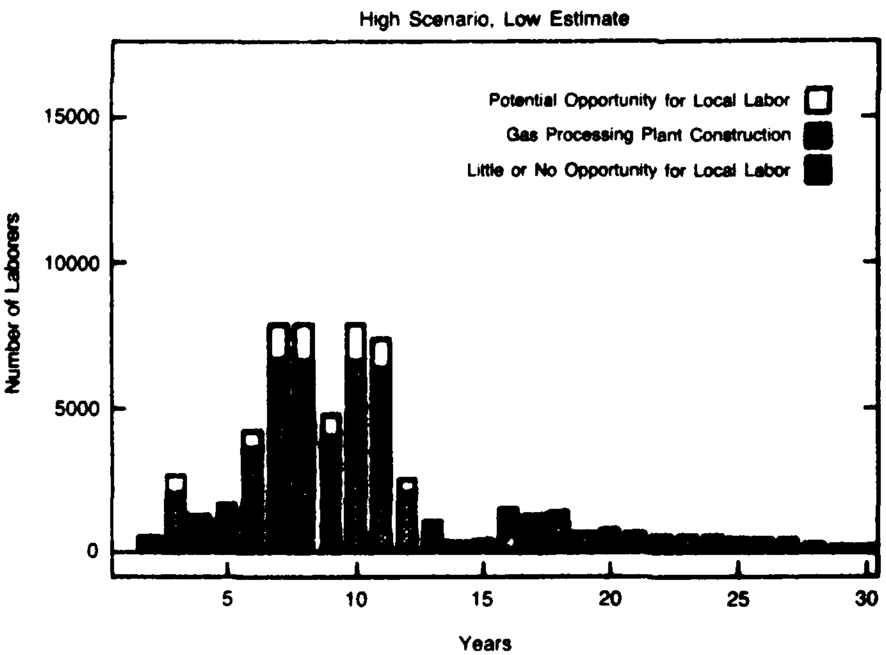


FIGURE 8-28
ESTIMATES OF DIRECT LABOR REQUIRED FOR ACTIVITIES IN ADJACENT FEDERAL WATERS UNDER THE HIGH SCENARIO

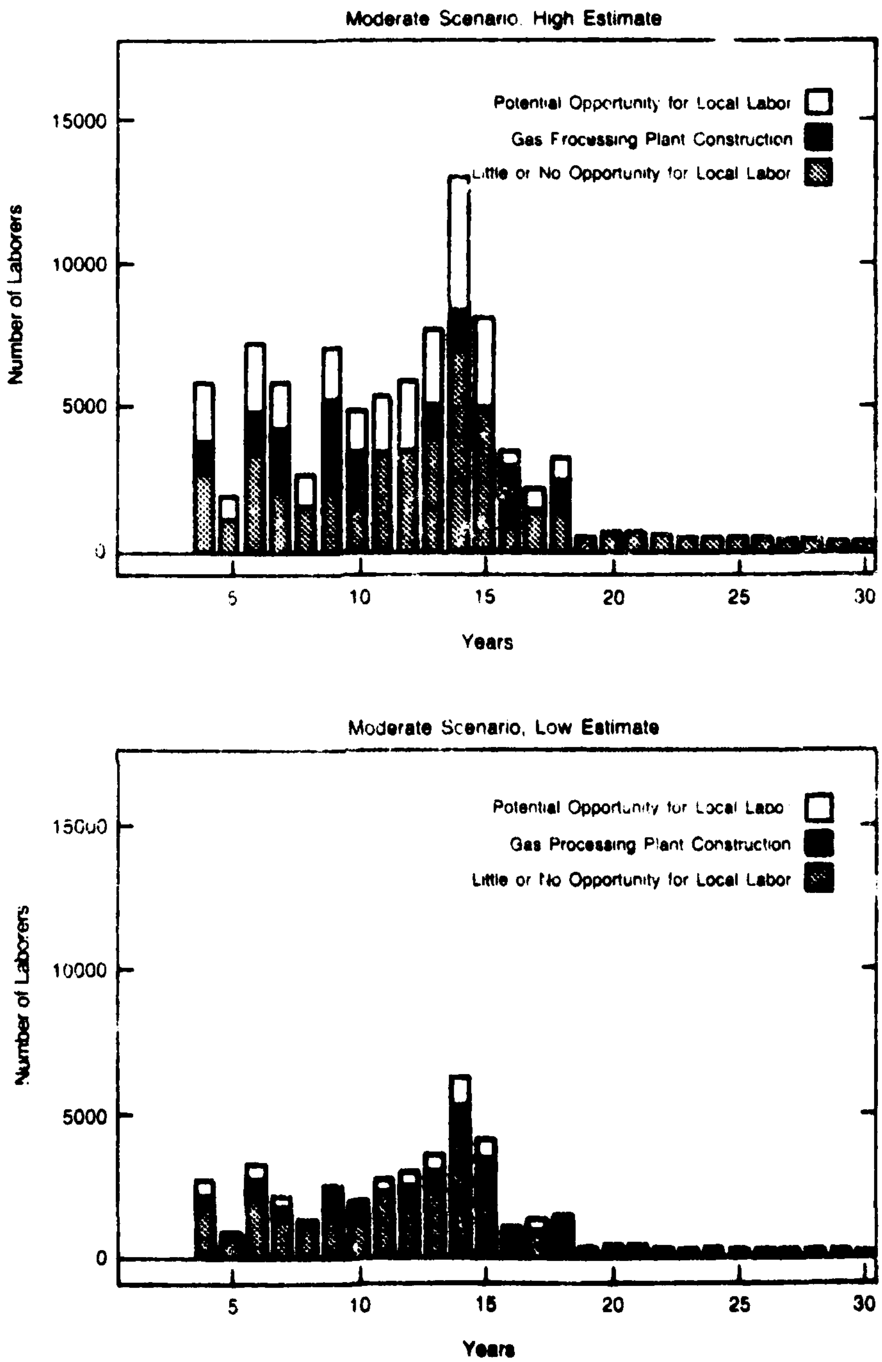


FIGURE 8-29
ESTIMATES OF DIRECT LABOR REQUIRED FOR ACTIVITIES ON THE ADJACENT FEDERAL WATERS UNDER THE MODERATE SCENARIO

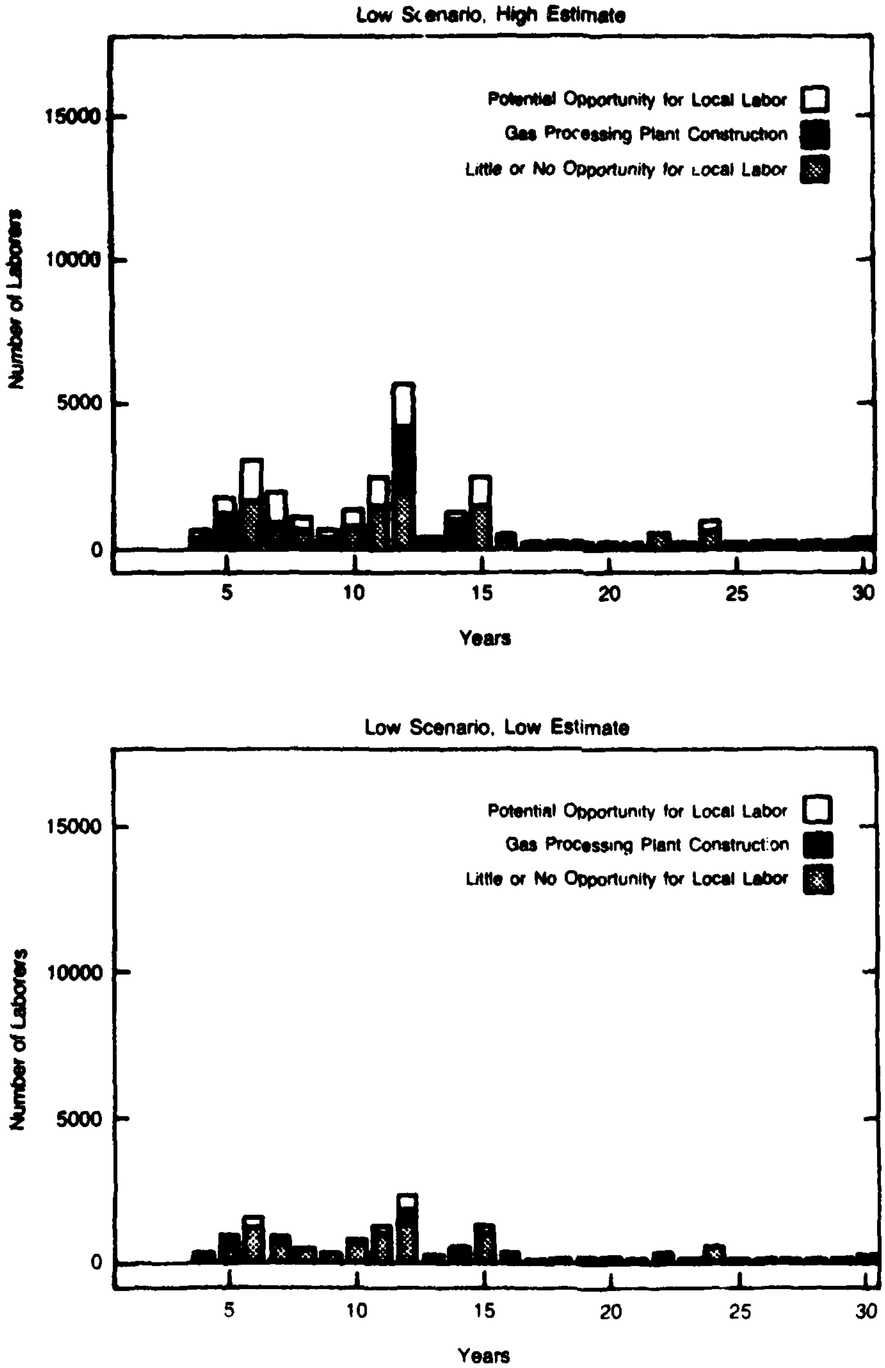


FIGURE 8-30
ESTIMATES OF DIRECT LABOR REQUIRED FOR ACTIVITIES ON THE ADJACENT FEDERAL WATERS UNDER THE LOW SCENARIO

workover crews. These occupations, as described in the unit action and Appendix F, draw from the southeastern region as a whole, not exclusively from the communities in the study area. The high estimates of each range under the high, moderate and low resource scenarios are used as input to the Economic Impact Assessment Model.

8.329 <u>Description of the Economic Impact Assessment Model (EIAM)</u>. The Economic Impact Assessment Model (EIAM) is a source of socioeconomic data, a tool for estimating the effects of development activities, and a mechanism by which a user can make sensitivity and policy analyses. EIAM consists of four modules: the Demographic Projection Module, the Employment Impact Module, the Public Costs Module, and the Public Revenues and Expenditures Module. Its geographic unit of reference is one county with adjacent counties included in the commuting radius.

8.330 In addition to its value as a source of data, EIAM is a simulation model with many parameters which the user may modify. It is this flexibility of parameters which allows sensitivity analyses by the user. EIAM's simulations run as follows. The resident population of a county and its neighboring counties is projected through the year 2000, incorporating the demographic factors of fertility, mortality, and migration. As with the census figures, the population projections are disaggregated by age, sex, and race. These projections provide a basis for determining the supply of available labor from which the planned industrial developments will draw workers. Whenever labor needs of the industrial activity cannot be met within the subject county, it is assumed that workers in neighboring counties are available and will commute to augment the labor pool. Furthermore, industrial developments tend to have multiplier effects. Simply stated, secondary employment such as service industries expands or contracts in response to the increase or decrease in the primary industrial workforce. EIAM includes these "spin-offs" in its analyses, handling them with the same assumption that in-migration will occur to meet any unfulfilled secondary labor requirements in the host county. The Public Costs Module then calculates the increments in annual public service and facility costs needed to support this increase or decrease in in-migrating population. Similarly, the Public Revenues and Expenditures Module calculates changes in public revenues and expenditures due to the flux in in-migrating population. The user can choose to run all or selected modules in EIAM and can rerun the same set of modules to observe sensitivity of results to parameter changes. Additional information on the EIAM is available in Appendix F.

8.331 <u>Input to and Results From the Economic Impact Assessment Model</u>. Six separate runs of the EIAM were conducted to assess the potential impact resulting from employment stimulated by hydrocarbon development offshore Alabama and Mississippi. The information used in each of the six runs is as follows:

- Run 1 - Under the High Scenario, the highest estimate of total labor needed for all occupations <u>with and without opportunity for local labor participation</u> from activities in the Mobile Delta, Mobile Bay, eastern Mississippi Sound, Alabama waters in the Gulf of Mexico and all of the adjacent federal OCS. Impact County - Jackson, MS.

- Run 2 - The same as Run 1 except that the impact county is Mobile, AL.

- Run 3 - Under the High Scenario, the highest estimate of labor needed for <u>occupations with the potential for local labor participation only</u> from activities in the same areas as Run 1. Impact County - Jackson, MS.

- Run 4 - The same as Run 3 except that the impact county is Mobile, AL.

- Run 5 - Under the High Scenario, the highest estimates of labor needed in occupations <u>with and without opportunity for local labor participation</u> *from activities offshore* Mississippi <u>in addition</u> to 50 percent of <u>labor with potential for local involvement only</u> generated by activity in federal waters. Impact County - Harrison, MS.

- Run 6 - Same as Run 5 except that the impact county is Hancock, MS.

8.332 The results from the first run indicate that in the unlikely event maximum employment from hydrocarbon development in state and federal territory converges on Jackson County, inmigration would result during two peak years (Table 8-28). The results from Run 2 reveal that same amount of in-migration could result, but Mobile County (Table 8-29) would receive the brunt of effects. The potential government revenues and expenditures that could result from the in-migration in each county as assessed by the EIAM are shown in Tables 8-30 through 8-33. It should be emphasized that Runs 1 and 2 have as input the maximum possible labor which includes all rig and workover crews, and other self-contained operations, occupations which generally offer little if any opportunity for local labor participation. In reality these activities draw from a much broader area extending throughout at least all gulf coast states.

TABLE 8-28

POTENTIAL POPULATION EFFECTS OF EMPLOYMENT-INDUCED MIGRATION
FROM ACTIVITIES IN THE MOBILE DELTA, BAY, EASTERN MISSISSIPPI SOUND,
ALABAMA GULF, AND THE ADJACENT FEDERAL OCS FOR JACKSON COUNTY, MISSISSIPPI

YEAR	NEW POP (BASIC)	NEW POP (SECONDARY)	TOTAL NEW	COUNTY PROJECTED BASELINE (DEMPRO)	BASELINE AND TOTAL NEW	NEW POP AS A % OF BASELINE	ANNUAL IMPACT RELATED GROWTH RATE
1980	0	0	0	118015	118015	0.0	0.0
1981	0	0	0	120933	120933	0.0	0.0
1982	0	0	0	123925	123925	0.0	0.0
1983	0	0	0	126991	126991	0.0	0.0
1984	0	0	0	130126	130126	0.0	0.0
1985	0	0	0	133334	133334	0.0	0.0
1986	0	0	0	136609	136609	0.0	0.0
1987	3979	0	3979	139955	143934	2.84	5.36
1988	3581	0	3581	143340	146921	2.50	3.71
1989	0	0	0	146769	146769	0.0	2.42
1990	0	0	0	150234	150234	0.0	2.41
1991	0	0	0	153666	153666	0.0	2.38
1992	0	0	0	157138	157138	0.0	2.36
1993	0	0	0	160642	160642	0.0	2.34
1994	0	0	0	164173	164173	0.0	2.32
1995	0	0	0	167719	167719	0.0	2.31
1996	0	0	0	170989	170989	0.0	2.27
1997	0	0	0	174578	174578	0.0	2.25
1998	0	0	0	178175	178175	0.0	2.24
1999	0	0	0	181768	181768	0.0	2.22
2000	0	0	0	185328	185328	0.0	2.20

TABLE 8-29

POTENTIAL POPULATION EFFECTS OF EMPLOYMENT-INDUCED MIGRATION FROM ACTIVITIES IN THE MOBILE DELTA, BAY, EASTERN MISSISSIPPI SOUND, ALABAMA GULF, AND THE ADJACENT FEDERAL OCS FOR MOBILE COUNTY, ALABAMA

YEAR	NEW POP (BASIC)	NEW POP (SECONDARY)	TOTAL NEW	COUNTY PROJECTED BASELINE ([illegible])	BASELINE AND TOTAL NEW	NEW POP AS A % OF BASELINE	ANNUAL [illegible] [illegible] [illegible]
1980	0	0	0	364980	364980	0.0	0.0
1981	0	0	0	369032	369032	0.0	0.0
1982	0	0	0	373037	373037	0.0	0.0
1983	0	0	0	376965	376965	0.0	0.0
1984	0	0	0	380818	380818	0.0	0.0
1985	0	0	0	384596	384596	0.0	0.0
1986	0	0	0	388206	388206	0.0	0.0
1987	3979	0	3979	391701	395680	1.02	1.95
1988	3581	0	3581	395055	398636	0.91	1.33
1989	0	0	0	398260	398260	0.0	0.86
1990	0	0	0	401343	401343	0.0	0.84
1991	0	0	0	403930	403930	0.0	0.80
1992	0	0	0	406428	406428	0.0	0.77
1993	0	0	0	408828	408828	0.0	0.74
1994	0	0	0	411124	411124	0.0	0.72
1995	0	0	0	413322	413322	0.0	0.70
1996	0	0	0	415343	415343	0.0	0.68
1997	0	0	0	417354	417354	0.0	0.66
1998	0	0	0	419339	419339	0.0	0.64
1999	0	0	0	421273	421273	0.0	0.63
2000	0	0	0	423153	423153	0.0	0.62

TABLE 8-30

POTENTIAL LOCAL GOVERNMENT REVENUES DUE TO CHANGING POPULATION CHARACTERISTICS, JACKSON COUNTY, MISSISSIPPI (MILLIONS OF DOLLARS)

YEAR	TRANSFERS FROM FEDERAL GOVERNMENT	TRANSFERS FROM STATE GOVERNMENT	PROPERTY TAX REVENUES	OTHER TAX REVENUES	CHARGES AND MISC.
1982	4.943	32.228	28.625	4.125	35.970
1983	6.273	33.342	30.463	4.431	37.494
1984	7.555	34.620	32.459	4.760	40.185
1985	8.845	35.891	34.669	5.116	42.571
1986	10.140	37.254	37.072	5.502	45.685
1987	11.480	38.609	39.770	5.930	48.589
1988	12.819	40.090	42.749	6.390	52.712
1989	14.186	41.580	46.097	6.892	56.931
1990	15.597	43.133	50.027	7.443	61.825
1991	17.077	44.699	54.261	8.031	67.850
1992	18.635	46.263	58.995	8.676	73.892

TABLE 8-31

POTENTIAL LOCAL GOVERNMENT REVENUES DUE TO CHANGING
POPULATION CHARACTERISTICS, MOBILE COUNTY, ALABAMA
(MILLIONS OF DOLLARS)

YEAR	TRANSFERS FROM FEDERAL GOVERNMENT	TRANSFERS FROM STATE GOVERNMENT	PROPERTY TAX REVENUES	OTHER TAX REVENUES	CHARGES AND MISC.
1982	$ 30.132	$ 76.708	$ 34.231	$ 46.428	$ 46.353
1983	$ 31.421	$ 79.566	$ 36.893	$ 49.192	$ 50.060
1984	$ 32.758	$ 82.477	$ 40.027	$ 52.138	$ 54.294
1985	$ 34.365	$ 85.472	$ 43.409	$ 55.317	$ 59.266
1986	$ 36.159	$ 88.497	$ 46.939	$ 58.649	$ 64.680
1987	$ 38.178	$ 91.543	$ 50.572	$ 62.235	$ 70.393
1988	$ 40.341	$ 94.633	$ 54.563	$ 65.997	$ 76.421
1989	$ 42.701	$ 97.899	$ 58.571	$ 69.974	$ 83.502
1990	$ 45.174	$ 101.223	$ 63.968	$ 74.149	$ 90.702
1991	$ 47.869	$ 104.580	$ 69.217	$ 78.094	$ 98.828
1992	$ 50.740	$ 108.117	$ 74.836	$ 82.185	$ 107.612

TABLE 8-32

POTENTIAL LOCAL GOVERNMENT EXPENDITURES DUE TO CHANGING POPULATION CHARACTERISTICS, JACKSON COUNTY, MISSISSIPPI (MILLIONS OF INFLATED DOLLARS)

YEAR	PERSONNEL AND OPERATIONS	CAPITAL SPENDING	EDUCATION SPENDING	POLICE SPENDING	HIGHWAY SPENDING	HOSPITAL SPENDING	LONG-TERM SCHOOL DEBT	GENERAL DEBT OUTSTANDING
1982	80.14	13.98	38.33	3.28	7.54	22.10	19.86	108.67
1983	96.05	16.03	42.17	3.91	8.88	23.09	19.82	105.78
1984	105.38	18.15	45.45	4.63	10.37	24.13	20.04	106.92
1985	114.73	20.36	48.97	5.44	11.79	25.22	20.84	105.45
1986	125.17	22.71	52.78	6.35	13.26	26.35	22.11	105.56
1987	136.97	25.20	56.93	7.38	14.58	27.54	23.67	103.71
1988	150.01	27.87	61.46	8.53	15.82	28.78	25.67	104.77
1989	164.60	30.74	66.44	9.83	16.99	30.07	28.28	104.84
1990	181.22	33.86	71.91	11.28	17.86	31.43	30.58	105.74
1991	199.30	37.25	78.03	12.90	18.79	32.84	35.13	107.52
1992	219.95	40.95	84.82	14.71	19.59	34.32	40.55	108.33

TABLE 8-33

POTENTIAL LOCAL GOVERNMENT EXPENDITURES DUE TO CHANGING
POPULATION CHARACTERISTICS, MOBILE COUNTY, ALABAMA
(MILLIONS OF INFLATED DOLLARS)

YEAR	PERSONNEL AND OPERATIONS	CAPITAL SPENDING	EDUCATION SPENDING	POLICE SPENDING	HIGHWAY SPENDING	HOSPITAL SPENDING	LONG-TERM SCHOOL DEBT	GENERAL DEBT OUTSTANDING
1982	185.60	60.65	92.39	16.42	17.69	0.0	27.54	304.41
1983	202.32	59.29	99.72	18.16	20.35	0.0	28.90	302.15
1984	220.43	58.87	103.49	20.07	23.07	0.0	30.93	301.07
1985	240.37	59.32	107.93	22.16	25.70	0.0	33.04	302.48
1986	261.87	60.54	112.98	24.43	28.47	0.0	36.15	303.59
1987	285.37	62.50	118.65	26.92	31.21	0.0	39.76	303.44
1988	310.96	65.15	124.93	29.63	34.08	0.0	43.93	302.49
1989	338.57	68.46	131.78	32.58	37.15	0.0	48.69	305.51
1990	370.21	72.42	139.21	35.79	39.37	0.0	50.88	306.85
1991	402.72	77.02	147.14	39.25	42.94	0.0	57.79	309.22
1992	437.87	82.26	155.68	43.02	46.93	0.0	64.87	313.38

8.333 Runs 3 and 4 have as input estimates of labor needed to fill only those occupations with potential local participation as explained in Appendix F. As in the first two runs, it is unlikely that all activity would converge as postulated. However, if even it were to occur, the model indicates that no in-migration would result. Since results from Runs 3 and 4 indicate no in-migration is likely, no effects on community services would occur.

8.334 Runs 5 and 6 are used to assess potential impacts in coastal Mississippi from offshore resource development. Although, the resources in the region are estimated to be concentrated offshore of Alabama, maximum employment in Mississippi is assumed to result from the following: Under the high scenario 50 percent of employment with the potential for local participation generated by activity on the federal waters, in addition to all activity offshore the three Mississippi counties converges on Harrison (Run 5) and then Hancock (Run 6) counties. The results of Runs 5 and 6 indicate no in-migration would result in either jurisdiction.

Potential State Revenues from Hydrocarbon Resource Development Offshore Alabama and Mississippi

8.335 Tables 8-34a and b and 8-35 contain possible revenues generated for Alabama and Mississippi under each of the three scenarios. The values assumed for oil, gas and condensate are those market values from late 1983. Total revenues for each scenario are based on the assumptions that all resources postulated are recovered, that they remain at current values, are taxed at current rates and that the royalty structure does not change.

8.335a State and local governments and the general populations of Alabama and Mississippi would benefit from lease sale monies, severance taxes and royalty payments resulting from increased hydrocarbon production. Alabama coffers could benefit by as much as $20 billion from taxes and royalties over the next 30 years (Tables 8-34a and 8-34b), under the assumptions stated above. Mississippi coffers could profit by $1.3 billion from these taxes and royalties. The distribution of these monies, in addition to earnings from the lease sales, would depend on changing legislatures and the issues they would deem important at future dates.

Land Use

8.336 The acreage potentially needed for processing facilities from resource development offshore Alabama, Mississippi and the adjacent federal waters is shown by Table 8-36. Under the high scenario a maximum of 1,200 acres could be needed for gas processing serving the resources in Alabama state waters, while at most 150 acres would be needed to accommodate resources from offshore Mississippi. If facilities serving development on the federal

TABLE 8-34a

POTENTIAL REVENUES FOR THE STATE OF ALABAMA FROM HYDROCARBON RESOURCE DEVELOPMENT IN THE MOBILE DELTA UNDER THE HIGH, MODERATE AND LOW RESOURCE SCENARIOS

Resource Scenario	Resource	Assumed Unit Value (dollars per quantity)	Total Resource Amount	Total Value (billion (dollars)	10% Severance Tax for Onshore Resources (billion (dollars)	25% Royalty To State (billion (dollars)	Total State Revenues (billion (dollars)
High	Oil	30/BBL	130 MMBBL	3.9	.390	.975	1.365
	Condensate	21-42/BBL	330 MMBBL	6.93-13.9	.693-1.39	1.732-3.47	2.425-4.86
	Gas	3.45/MMBTU[a]	2.2 TCF	7.59	.759	1.9	2.659
						Total	6.45-8.88
Moderate	Oil	30/BBL	88 MMBBL	2.64	.264	.660	.924
	Condensate	21-42/BBL	260 MMBBL	5.46-10.9	.546-1.09	1.365-2.725	1.91-3.815
	Gas	3.45/MMBTU[a]	1.8 TCF	6.21	.621	1.55	2.17
						Total	5.004-6.91
Low	Oil	30/BBL	60 MMBBL	1.8	.18	.450	.63
	Condensate	21-42/BBL	213 MMBBL	4.47-8.946	.447-.8946	1.12-2.24	1.567-3.135
	Gas	3.45/MMBTU[a]	1.5 TCF	5.175	.517	1.29	1.807
						Total	4.004-5.572

[a]*1000 BTU = 1 cubic foot of gas.*

TABLE 8-34b

POTENTIAL REVENUES FOR THE STATE OF ALABAMA FROM OFFSHORE HYDROCARBON RESOURCE DEVELOPMENT UNDER THE HIGH, MODERATE AND LOW RESOURCE SCENARIOS

Resource Scenario	Resource	Assumed Unit Value (dollars per quantity)	Total Resource Amount	Total Value (billion dollars)	8% Severance Tax for Offshore Resources (billion dollars)	25% Royalty To State (billion dollars)	Total State Revenues (billion dollars)
High	Oil	30/BBL	72 MMBBL	2.16	.173	.54	.713
	Condensate	21-42/BBL	470.5 MMBBL	9.9-19.7	.790-1.6	2.475-4.925	3.265-6.525
	Gas	3.45/MMBTU[a]	5.225 TCF	18	1.44	4.5	5.94
						Total	9.92-13.18
Moderate	Oil	30/BBL	--	--	--	--	--
	Condensate	21-42/BBL	119.5 MMBBL	2.5-5.02	.2-.4	.625-1.25	.825-1.65
	Gas	3.45/MMBTU[a]	3.35 TCF	11.6	.928	2.9	3.83
						Total	4.65-5.48
Low	Oil	30/BBL	--		--	--	--
	Condensate	21-42/BBL	90.9 MMBBL	1.9-3.82	.153-.305	.475-.955	.628-1.26
	Gas	3.45/MMBTU[a]	2.4 TCF	8.3	.664	2.1	2.76
						Total	3.39-4.02

[a]1000 BTU = 1 cubic foot of gas.

TABLE 8-35

POTENTIAL REVENUES FOR THE STATE OF MISSISSIPPI FROM OFFSHORE HYDROCARBON RESOURCE DEVELOPMENT UNDER THE HIGH, MODERATE AND LOW RESOURCE SCENARIOS

Resource Scenario	Resource	Assumed Unit Value (dollars per quantity)	Total Resource Amount	Total Value (billion dollars)	6% Severence Tax (million dollars)	20% Royalty To State (million dollars)	Maintenance Tax (2¢/BBL liquid, .2¢/$1000 CFGAS)	Total State Revenues (billion dollars)
High	Oil							
	Condensate	21-42/BBL	30.5 MMBBL	.640-1.28	38.4-76.8	128-256	610,000	.167-.333
	Gas	3.45/MMBTUs[a]	1.15 TCF	3.97	238	794	2.3 million	1.03
							Total	1.19-1.36
Moderate	Oil							
	Condensate	21-42/BBL	1.1 MMBBL	.023-.046	1.3-2.76	4.6-9.2	22,000	.006-.012
	Gas	3.45/MMBTU[a]	.08 TCF	.276	16.5	55.2	160,000	.072
							Total	.078-.084
Low	Oil							
	Condensate	21-42/BBL	.325 MMBBL	.0068-.014	.408-.816	1.36-2.72	6,500	.002-.0035
	Gas	3.45/MMBTU[a]	.0225 TCF	.0776	4.65	15.5	45,000	.020
							Total	.022-.023

[a]1000 BTU = 1 cubic foot of gas.

TABLE 8-36

ACREAGE POTENTIALLY REQUIRED FOR GAS PROCESSING FACILITIES FROM RESOURCE DEVELOPMENT OFFSHORE ALABAMA, MISSISSIPPI AND ON THE ADJACENT FEDERAL OCS

Area With Resource Development	High Scenario		Moderate Scenario		Low Scenario	
	Number of Plants	Number of Acres Required (20-75 Per Plant)	Number of Plants	Number of Acres Required (20-75 Per Plant)	Number of Plants	Number of Acres Required (20-75 Per Plant)
ALABAMA						
Mobile Delta	6	120-450	4	80-300	4	80-300
Mobile Bay, Alabama Gulf Waters and Alabama Territory in Miss. Sound[a]	10[a] 16	200-750 320-1,200	10[a] 14[a]	200-750 280-1,050	10[a] 14[a]	200-750 280-1,050
TOTAL ALABAMA	16	320-1,200	14[a]	280-1,050	14[a]	280-1,050
MISSISSIPPI						
Gulf of Mexico and Mississippi Sound MS. Waters	2[a]	40-150	2[a]	40-150	1	20-75
FEDERAL OCS	19	380-1,425	13	260-975	9	180-675

[a]The number of processing facilities are postulated to be the same among different scenarios, because the timing of development and location of different fields bears on the likelihood of joint facilities being built (discussed in Appendix F). Although the number of plants may be the same, the capacities installed differ according to the resource scenarios.

waters under the high scenario are added to the acreage, over 2,600 acres could be needed. Assuming that the area between Pascagoula and the western shore of Mobile Bay is the chief impact zone, currently, there would be sufficient industrial acreage and vacant undeveloped land for the maximum number of plants. Available industrial acreage in coastal Mississippi is shown in Table 8-37. In Pascagoula, and in Mobile's Bayou Jones Industrial Parks alone there are over 3,000 acres available (Mississippi Research and Development Center, 1982b; U.S. Army Corps of Engineers, 1982a).

8.337 Projected industrial land use in Mobile and Baldwin counties for the year 2000 is shown in Table 8-38.. Between the two counties over 84,000 acres will remain undeveloped by the year 2000. Available acreage then would be more than sufficient to accommodate potential processing facilities.

Accidental Release of Natural Gas Containing Hydrogen Sulfide

Pipeline Rupture

8.338 In addition to the upland sections of pipelines from development in the study waters, pipelines from development in Federal OCS waters would also have upland sections. The probability of an accidental release of natural gas from pipelines was calculated using a modified pipeline leak detection model (Appendix E). The incident frequencies for pipeline releases on uplands, both with and without the federal pipeline segments, are given in Table 8-39.

TABLE 8-37

AVAILABLE INDUSTRIAL ACREAGE IN COASTAL MISSISSIPPI

County and City	Available Industrial Acreage
Jackson[a]	1,255[a]
Pascagoula	1,205[a]
Gautier	50[a]
Harrison[a]	1,124[a]
Long Beach	424[a]
Gulfport	
Hancock[b]	1,169[b]
Total Mississippi Coast	3,548

[a]Source: Mississippi Research and Development Center 1982b.
[b]Source: Hode, 1976.

TABLE 8-38

PROJECTED INDUSTRIAL AND UNDEVELOPED LAND USE FOR
MOBILE AND BALDWIN COUNTIES IN THE YEAR 2000

Land Use	1975 Mobile Acres	1975 Baldwin Acres	2000 Mobile Acres	2000 Baldwin Acres
Developed	626,172	760,964	665,630	778,640
Industrial	4,808	568	8,350	1,330
Undeveloped	167,428	295,418	127,970	277,742
Vacant	66,887	74,874	27,429	57,198

Source: Friend et al., 1982.

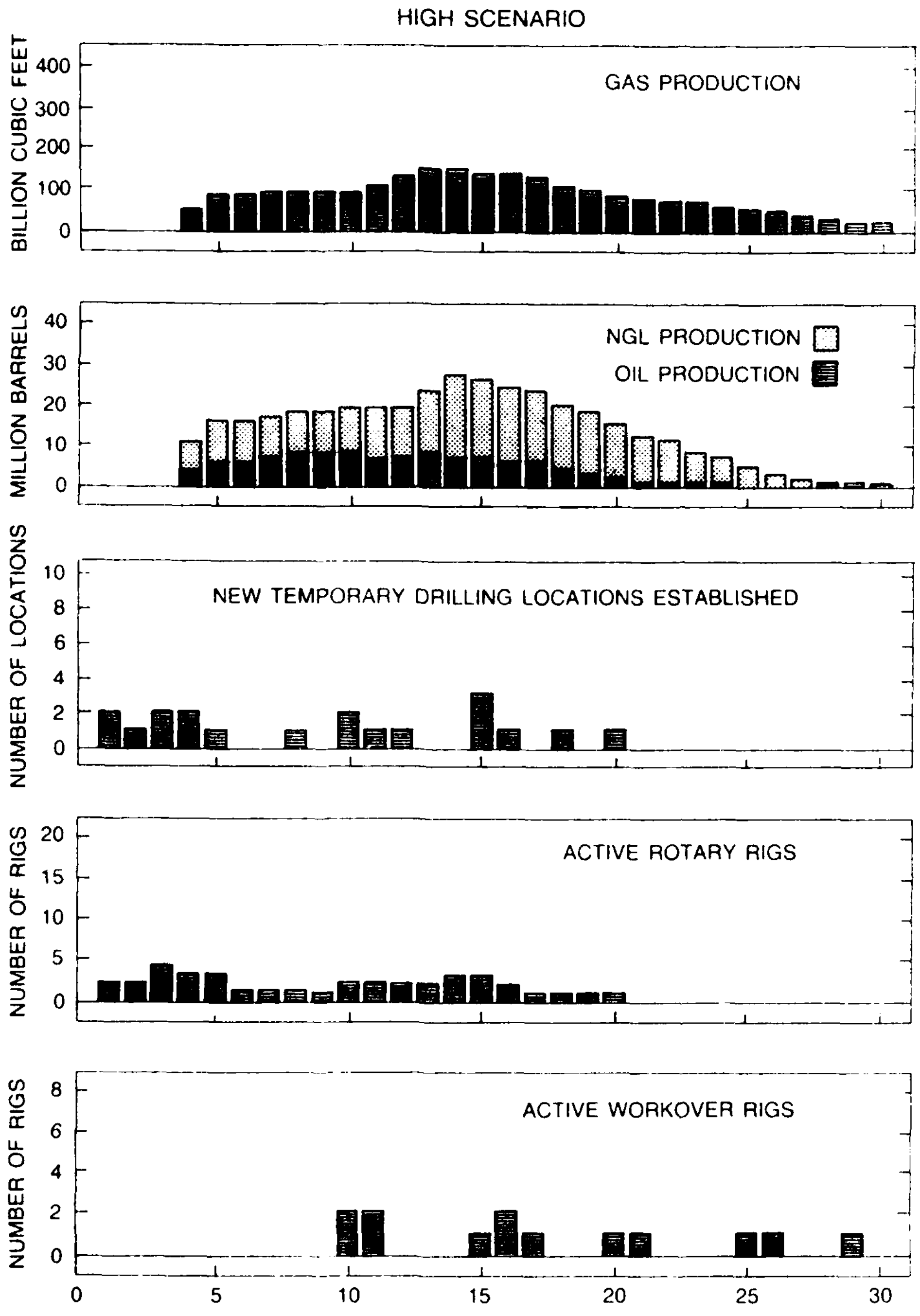
TABLE 8-39

PIPELINE RELEASE INCIDENT FREQUENCY
UPLANDS AREAS

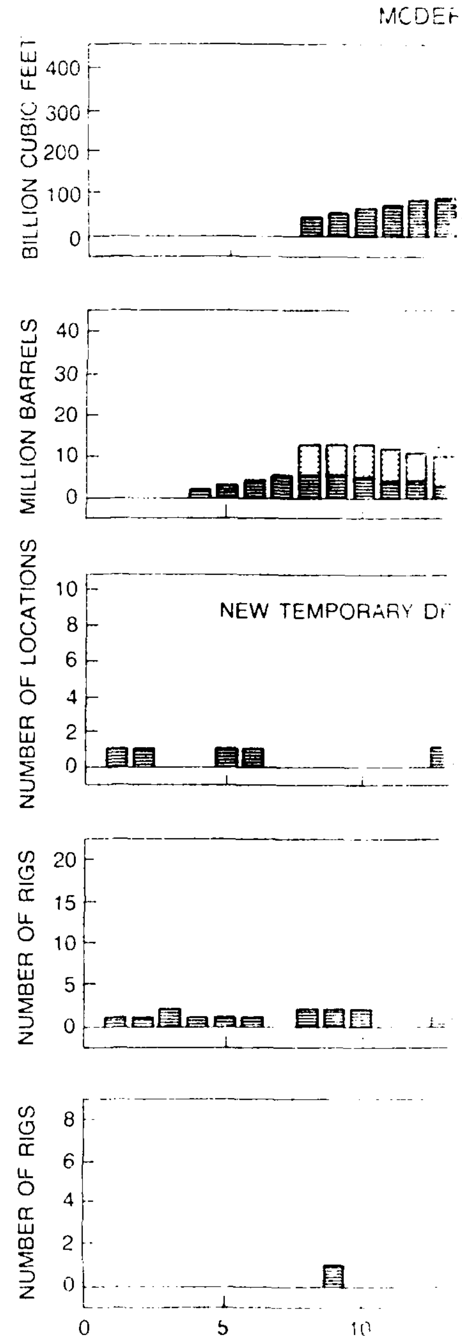
Resource Scenario	Pipeline Mileage	Incident Frequency[a] (in years)
	Upland Area Pipelines Only	
High	267	2.7
Moderate	215	3.4
Low	163	4.4
	Upland Area with Federal OCS Pipelines	
High	438	1.7
Moderate	383	1.9
Low	268	2.7

[a]Incident - any pipeline release, from the smallest possible leak to a pipeline rupture.

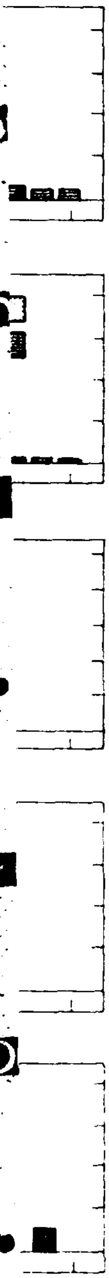
Frequency - the number of years for such an incident to occur.

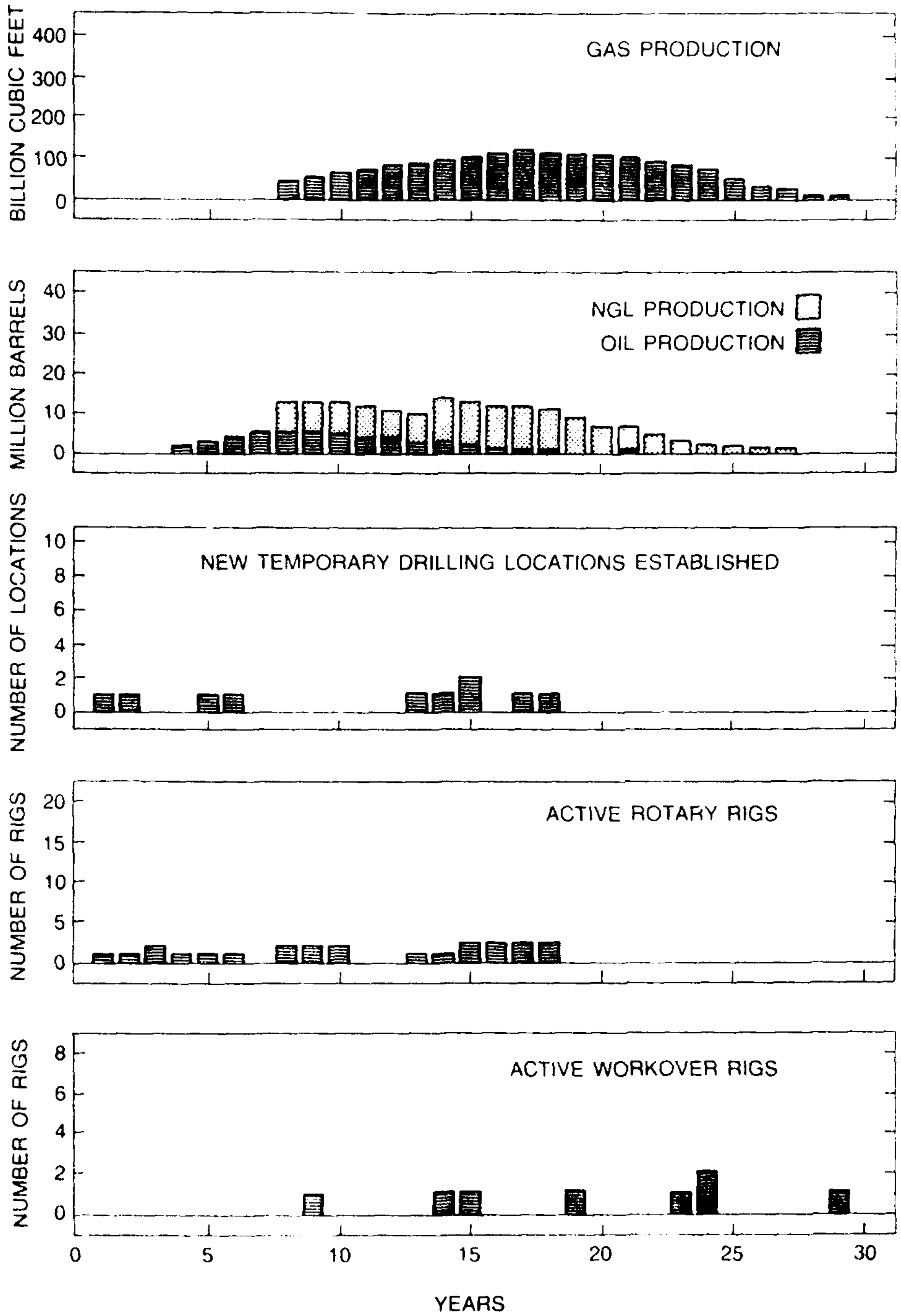

HIGH SCENARIO
GAS PRODUCTION
BILLION CUBIC FEET
NGL PRODUCTION
OIL PRODUCTION
MILLION BARRELS
NEW TEMPORARY DRILLING LOCATIONS ESTABLISHED
NUMBER OF LOCATIONS
ACTIVE ROTARY RIGS
NUMBER OF RIGS
ACTIVE WORKOVER RIGS
NUMBER OF RIGS
0 5 10 15 20 25 30

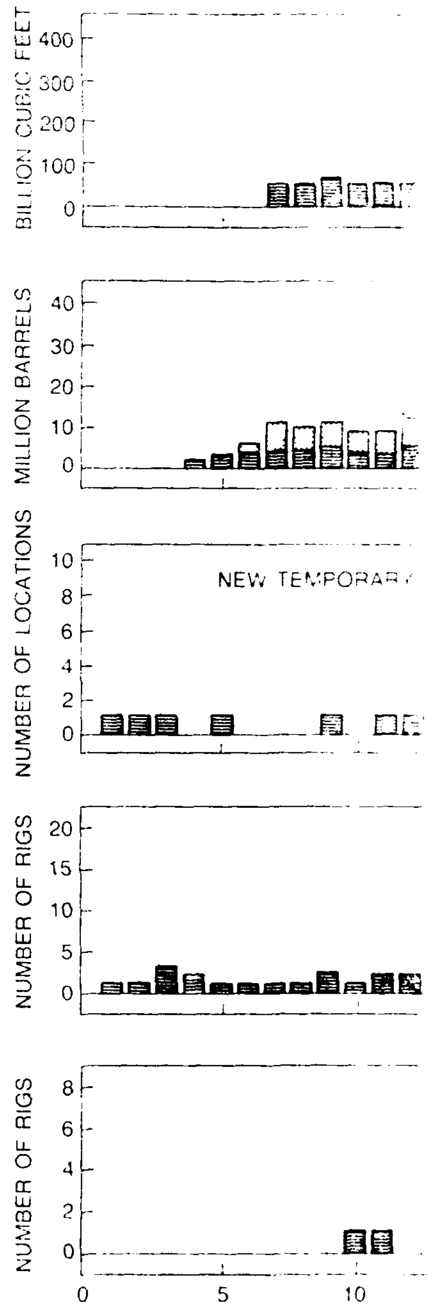
YEARS


BILLION CUBIC FEET
MILLION BARRELS
NUMBER OF LOCATIONS
NUMBER OF RIGS
NUMBER OF RIGS

MODERATE SCENARIO







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ACTIVITIES
FR
RESOUR

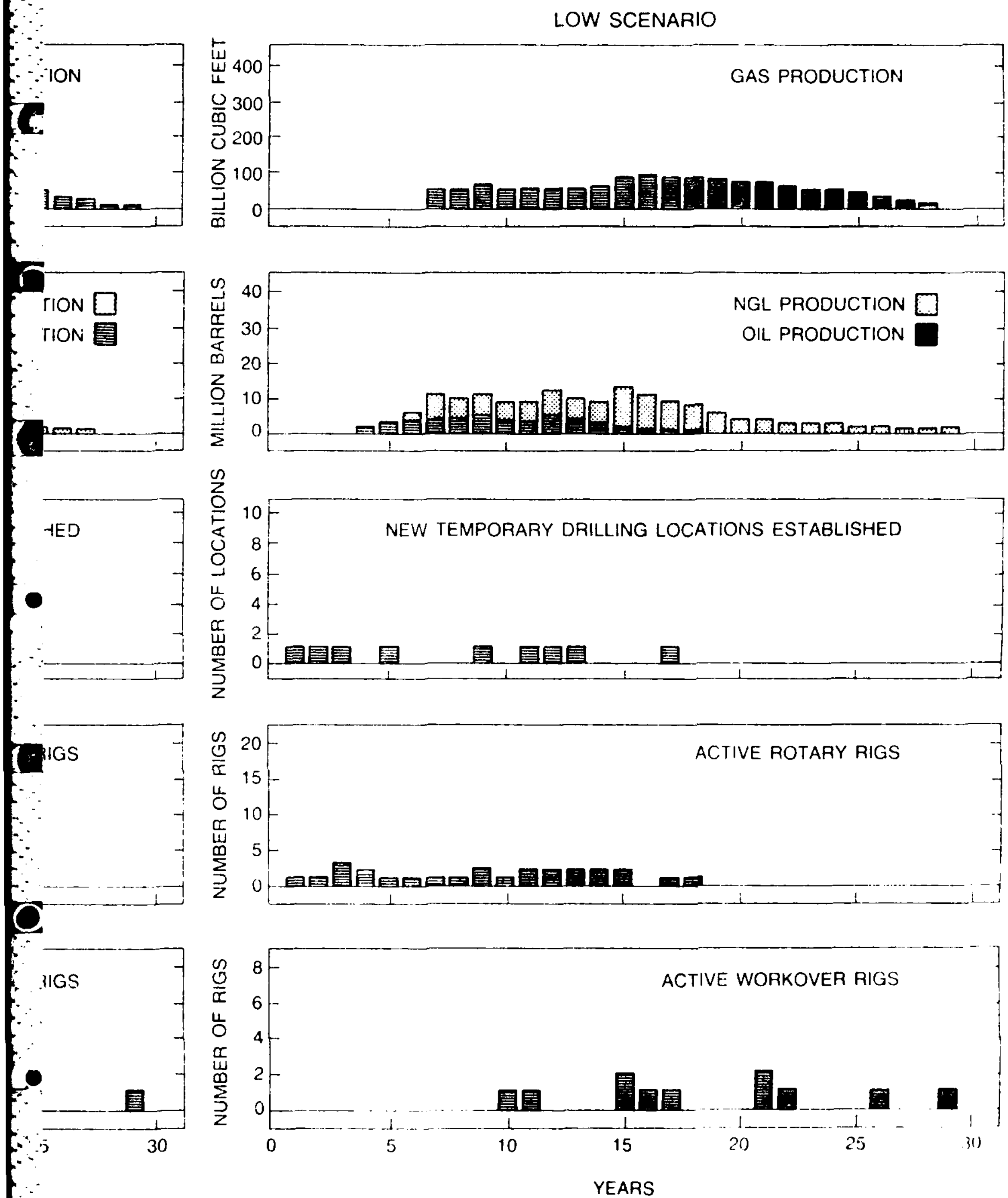
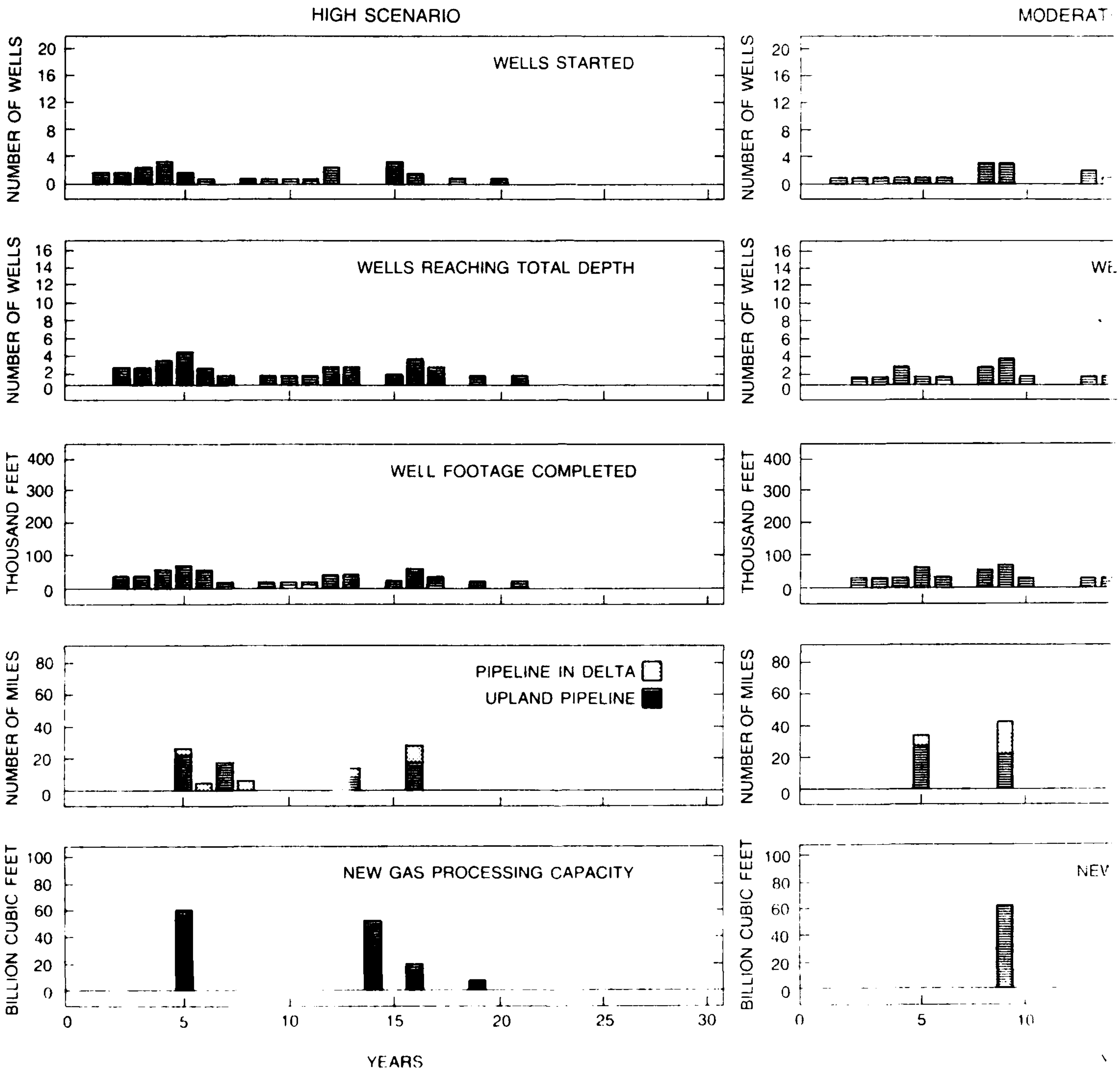
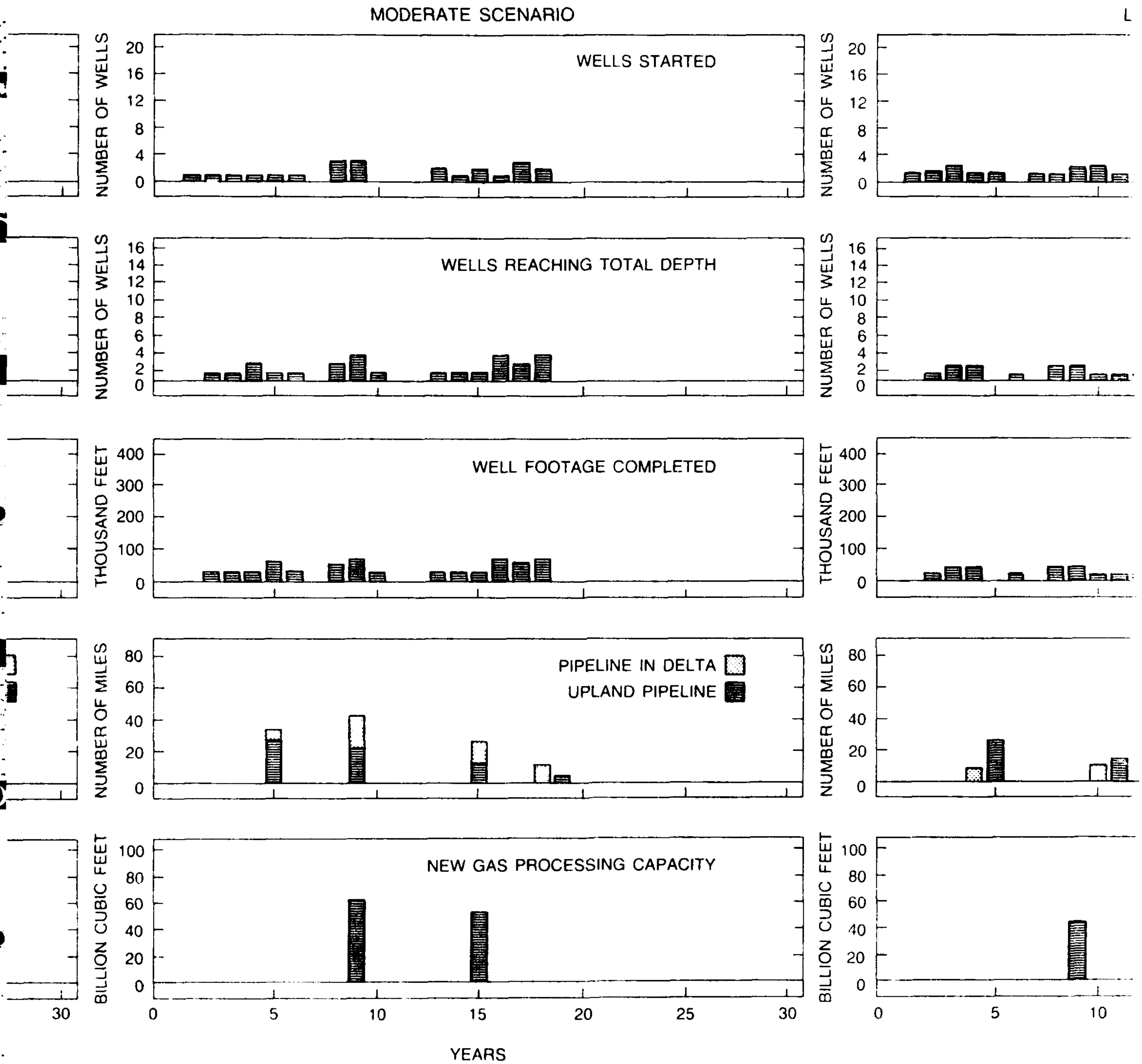


FIGURE 8-1
ACTIVITIES IN THE MOBILE DELTA RESULTING FROM THE HYDROCARBON RESOURCE DEVELOPMENT SCENARIOS


HIGH SCENARIO
MODERAT
WELLS STARTED
NUMBER OF WELLS
WELLS REACHING TOTAL DEPTH
WELL FOOTAGE COMPLETED
THOUSAND FEET
PIPELINE IN DELTA
UPLAND PIPELINE
NUMBER OF MILES
NEW GAS PROCESSING CAPACITY
BILLION CUBIC FEET
YEARS



ACTIVITIE'

RESOU

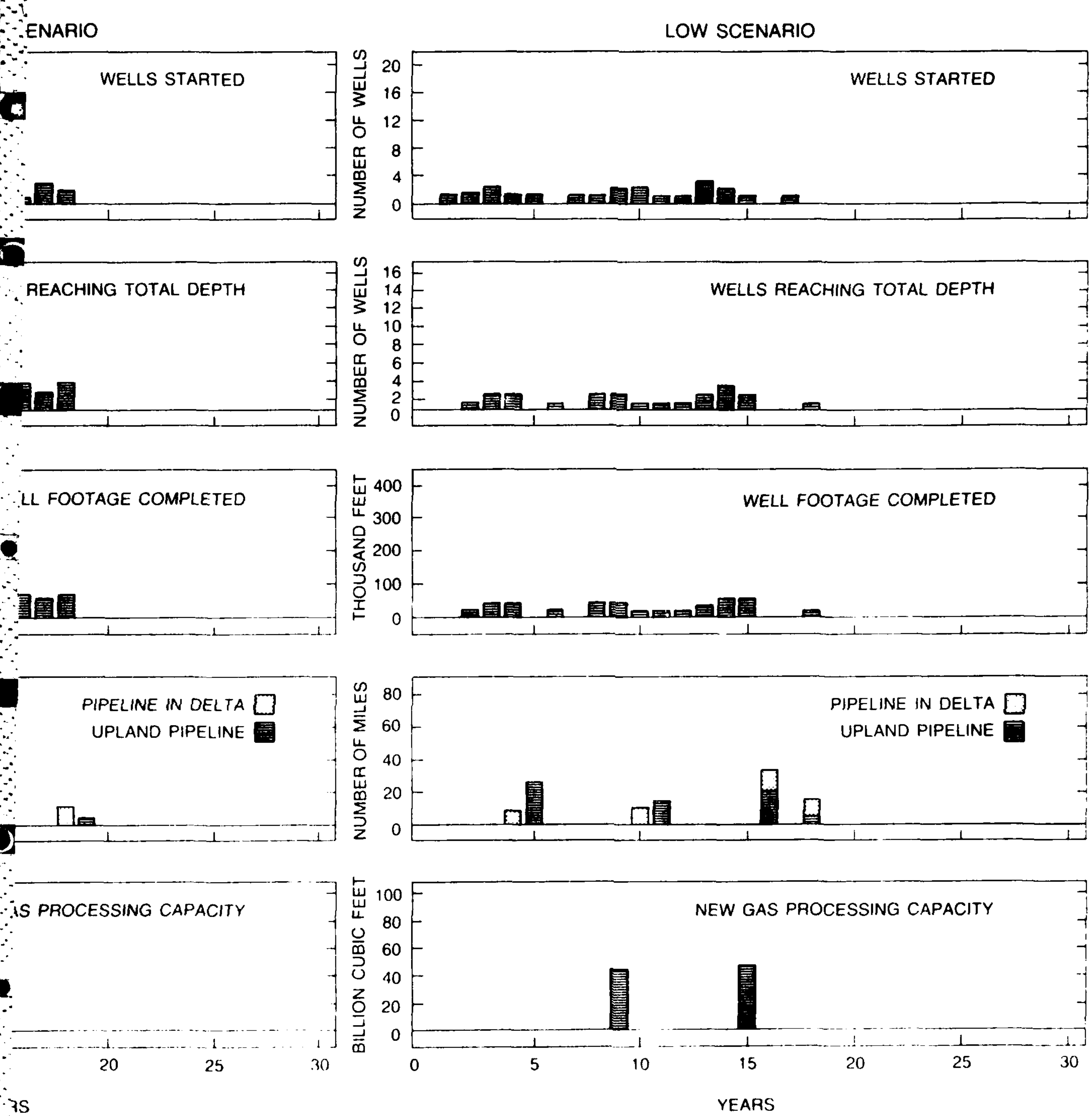
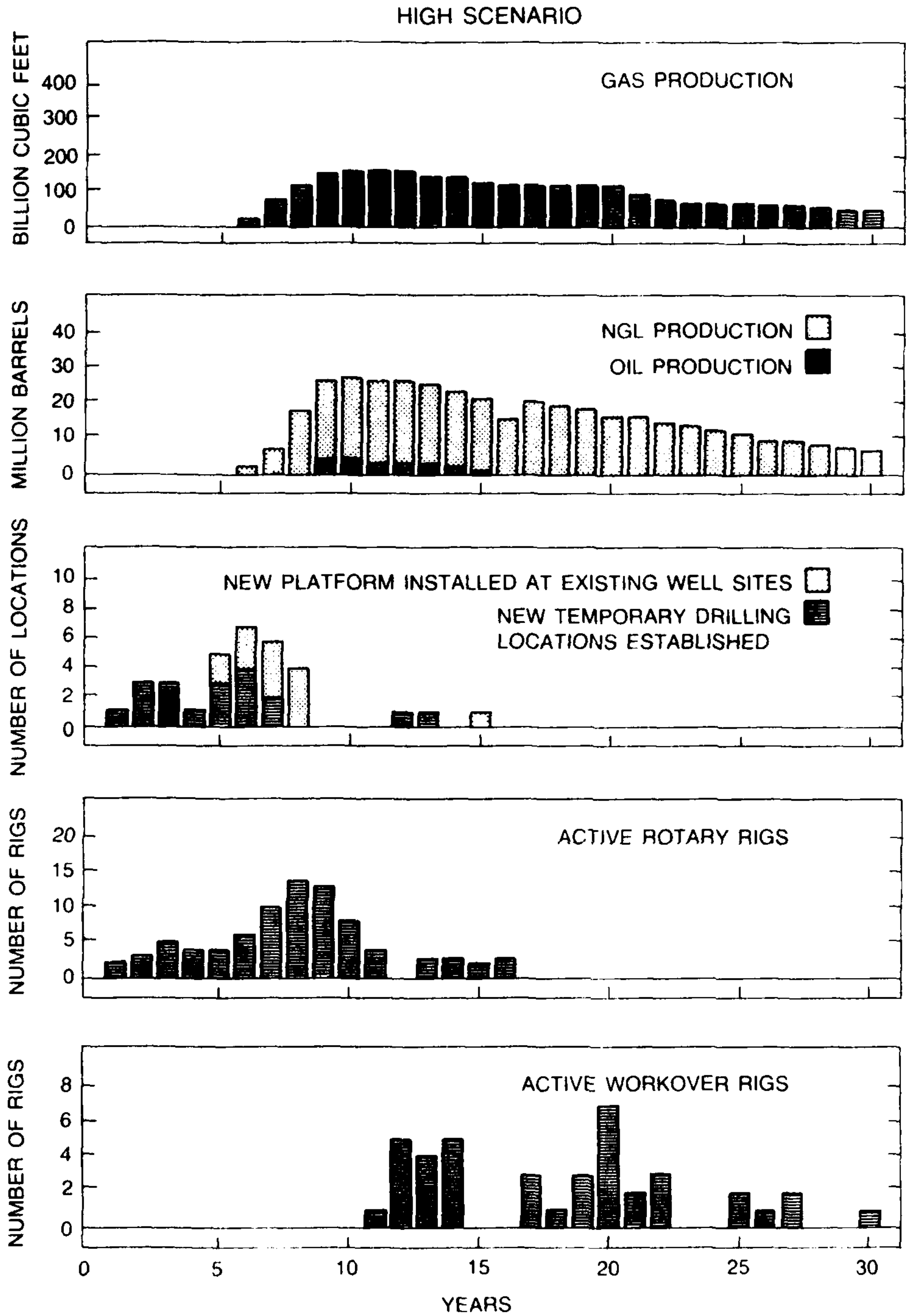
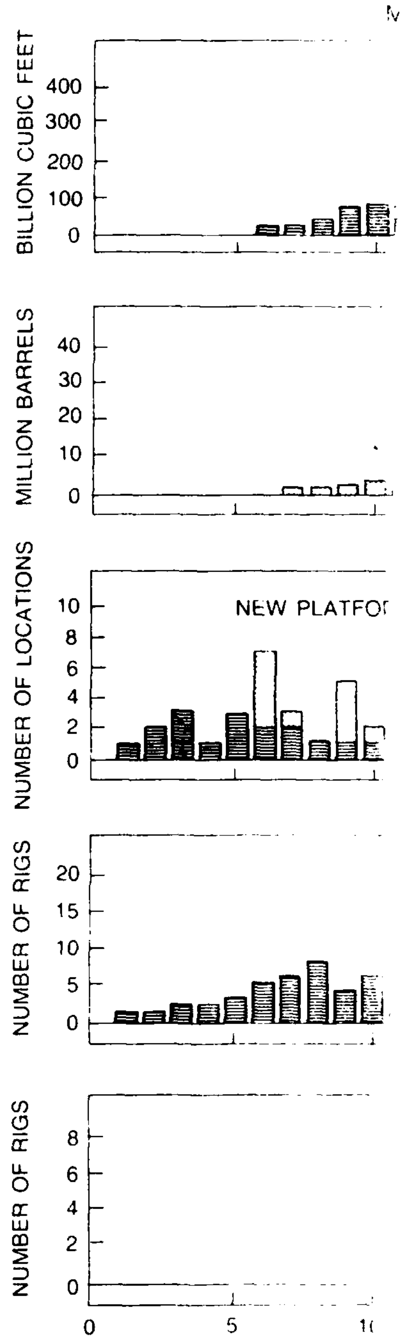
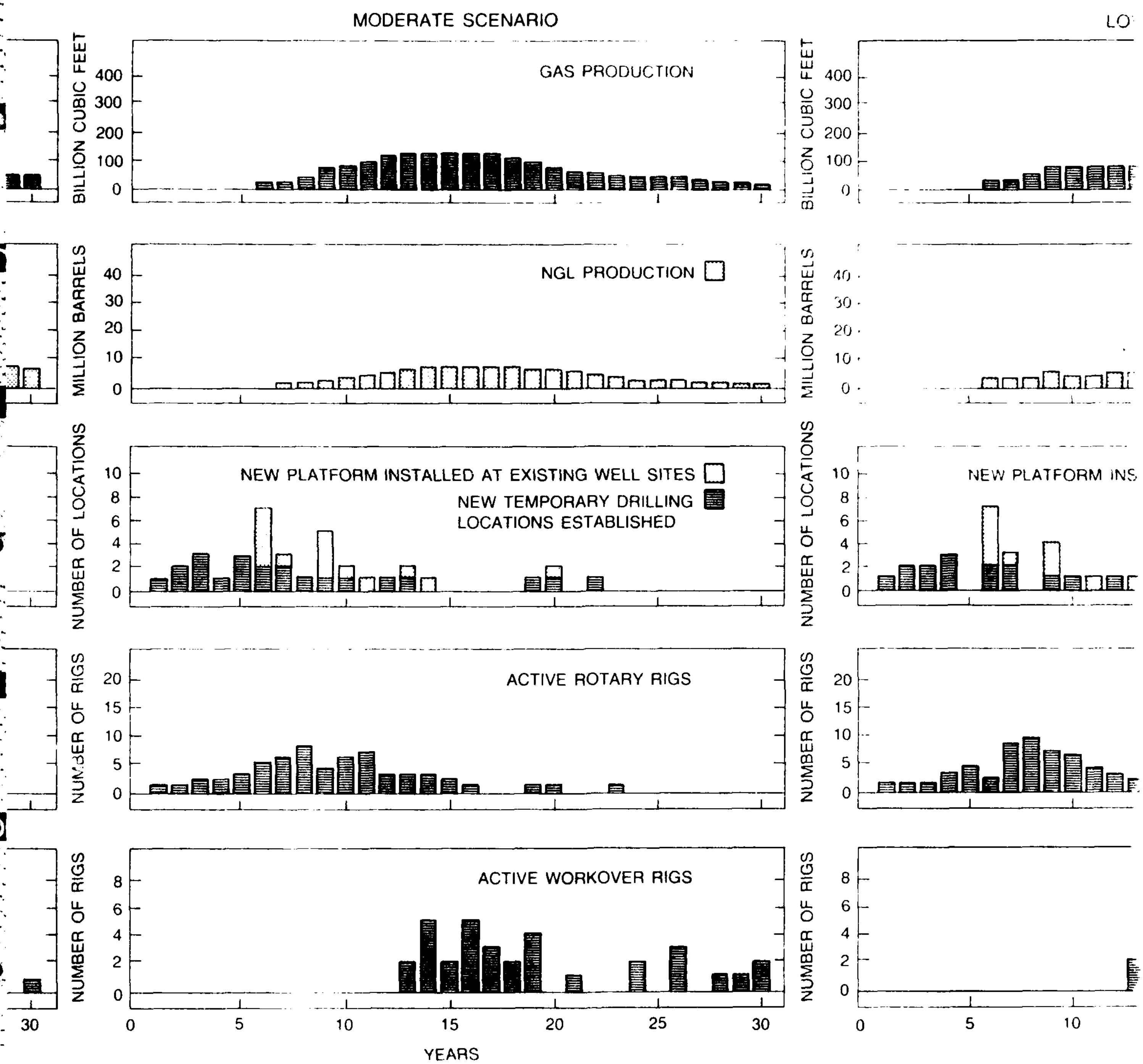


FIGURE 8-1
ACTIVITIES IN THE MOBILE DELTA RESULTING FROM THE HYDROCARBON RESOURCE DEVELOPMENT SCENARIOS (CONTINUED)


HIGH SCENARIO
GAS PRODUCTION
BILLION CUBIC FEET
0
100
200
300
400
NGL PRODUCTION
OIL PRODUCTION
MILLION BARRELS
0
10
20
30
40
NEW PLATFORM INSTALLED AT EXISTING WELL SITES
NEW TEMPORARY DRILLING LOCATIONS ESTABLISHED
NUMBER OF LOCATIONS
0
2
4
6
8
10
ACTIVE ROTARY RIGS
NUMBER OF RIGS
0
5
10
15
20
ACTIVE WORKOVER RIGS
NUMBER OF RIGS
0
2
4
6
8
0
5
10
15
20
25
30
YEARS


BILLION CUBIC FEET
0
100
200
300
400
MILLION BARRELS
0
10
20
30
40
NUMBER OF LOCATIONS
0
2
4
6
8
10
NUMBER OF RIGS
0
5
10
15
20
NUMBER OF RIGS
0
2
4
6
8
0
5



ACTIVITIES II
FROM THE HYDROCA

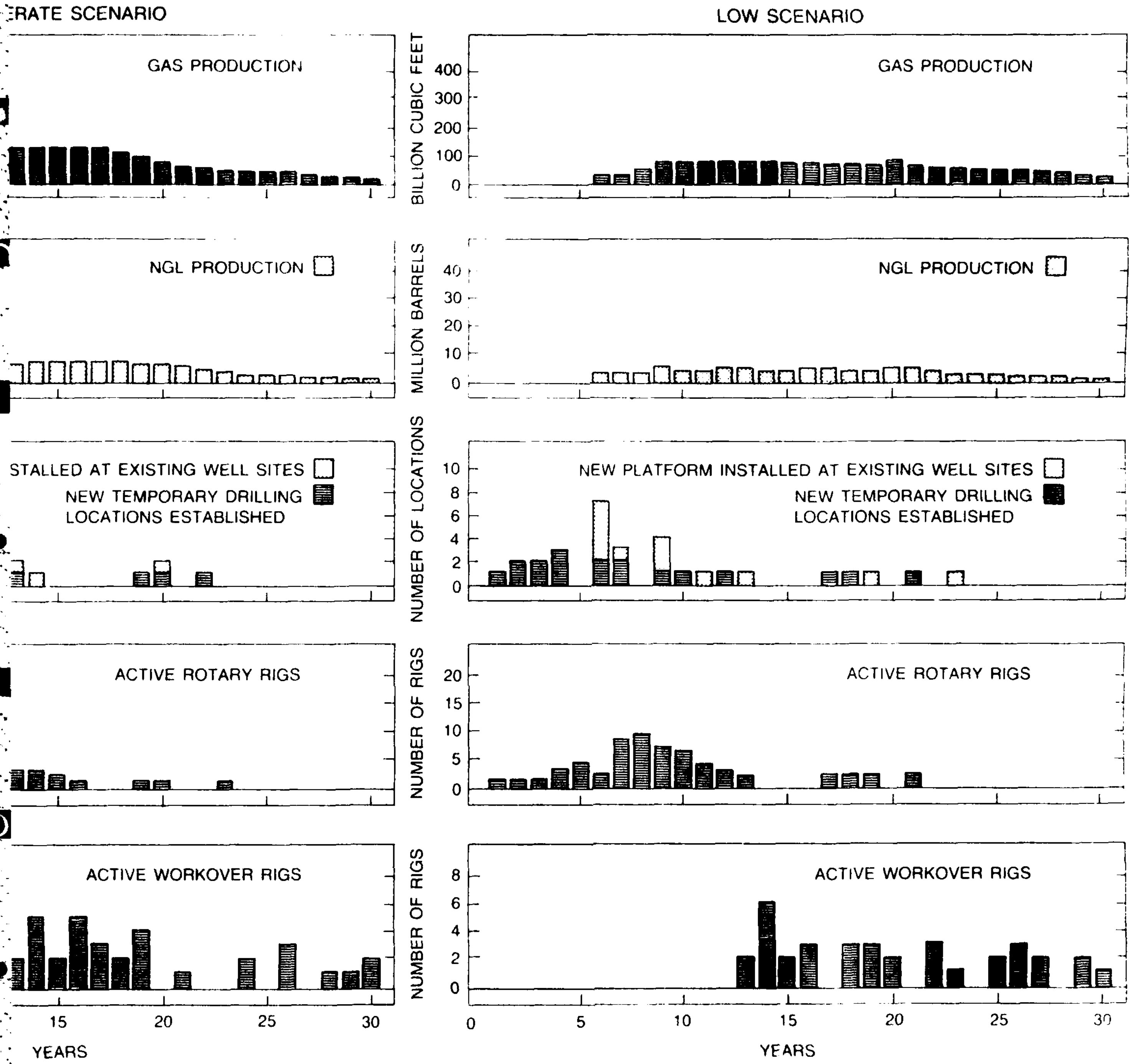
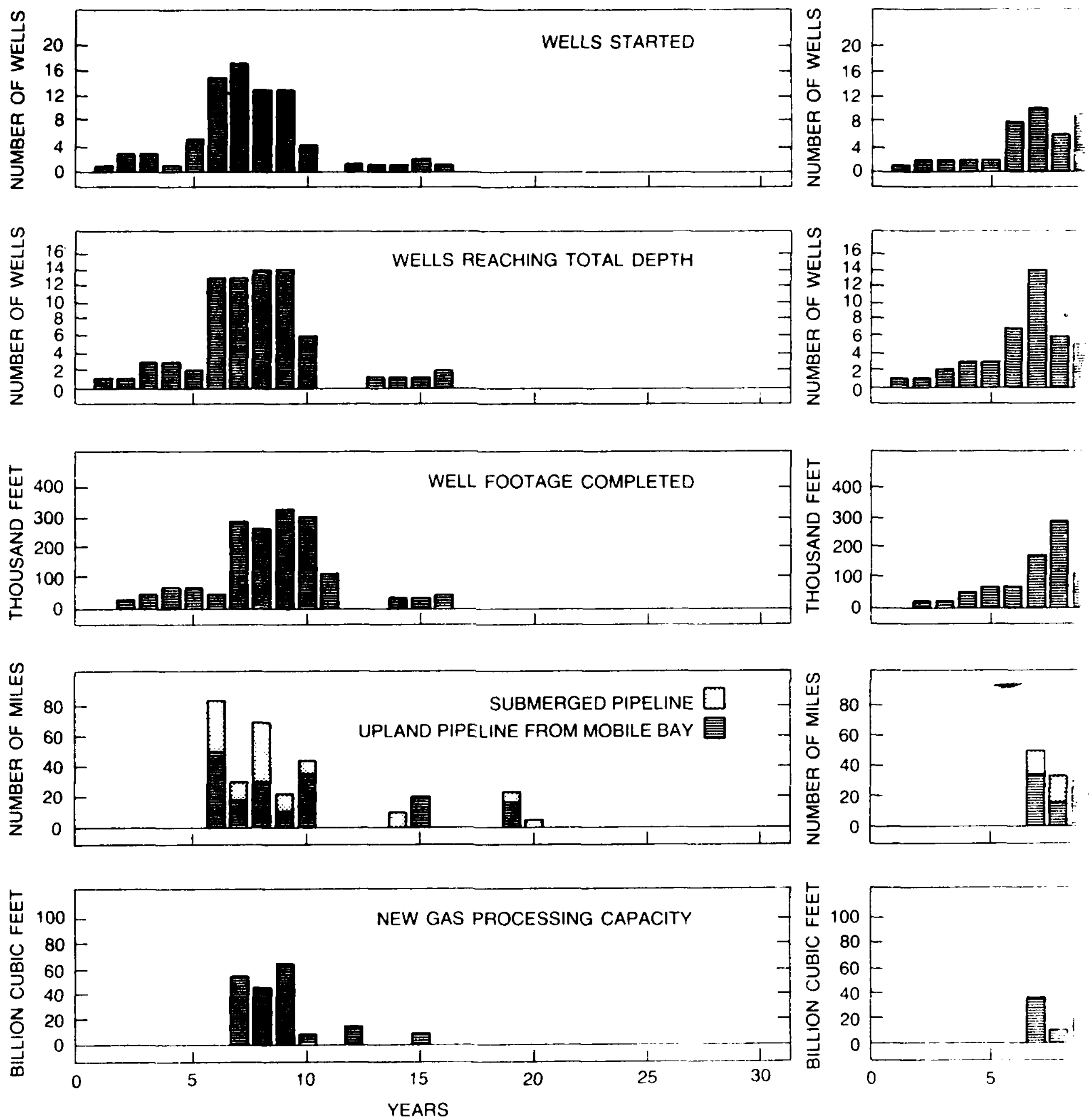
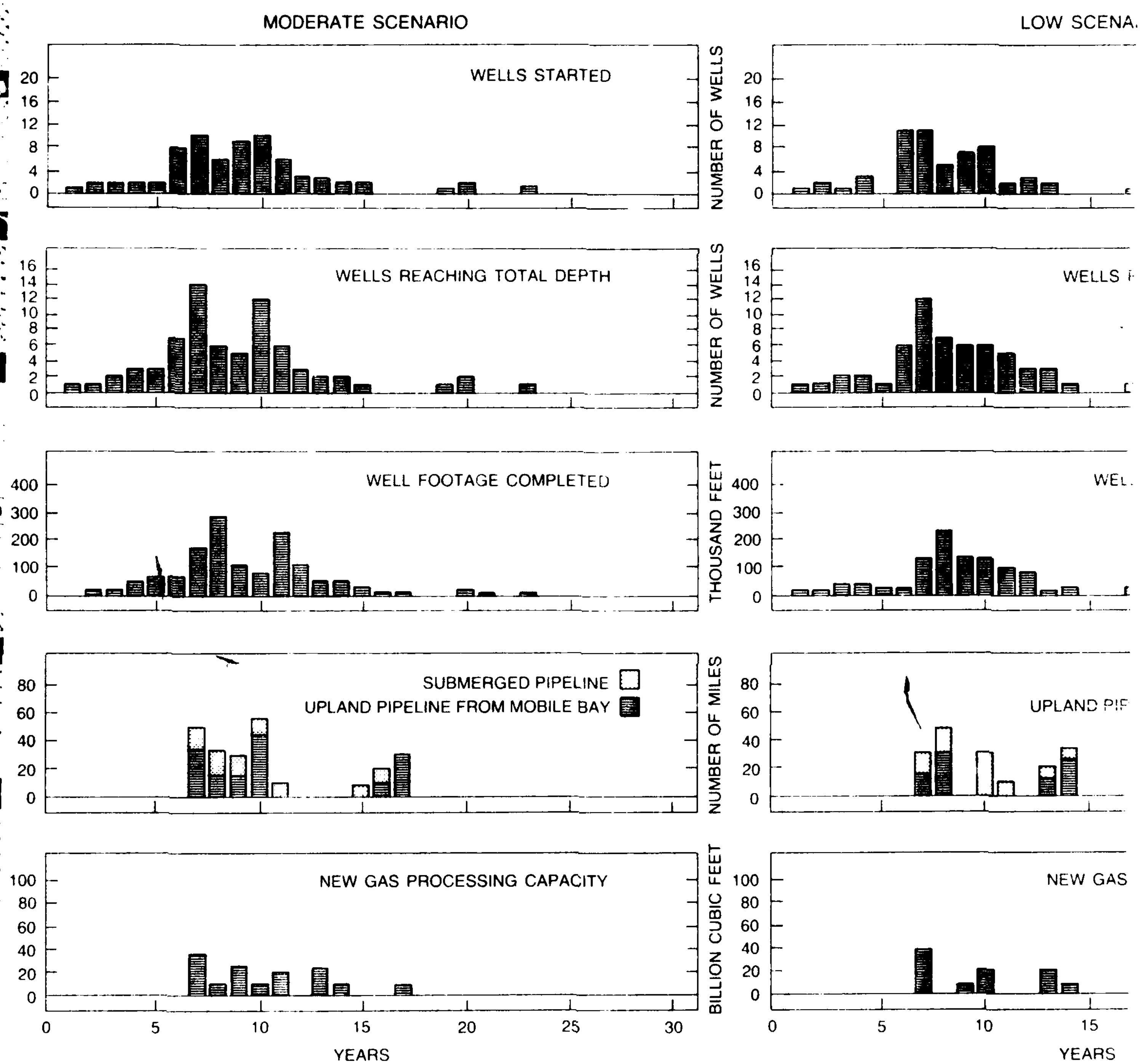


FIGURE 8-2
ACTIVITIES IN MOBILE BAY RESULTING FROM THE HYDROCARBON DEVELOPMENT SCENARIOS

HIGH SCENARIO





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ACTIVITIES
FROM
DEVEL

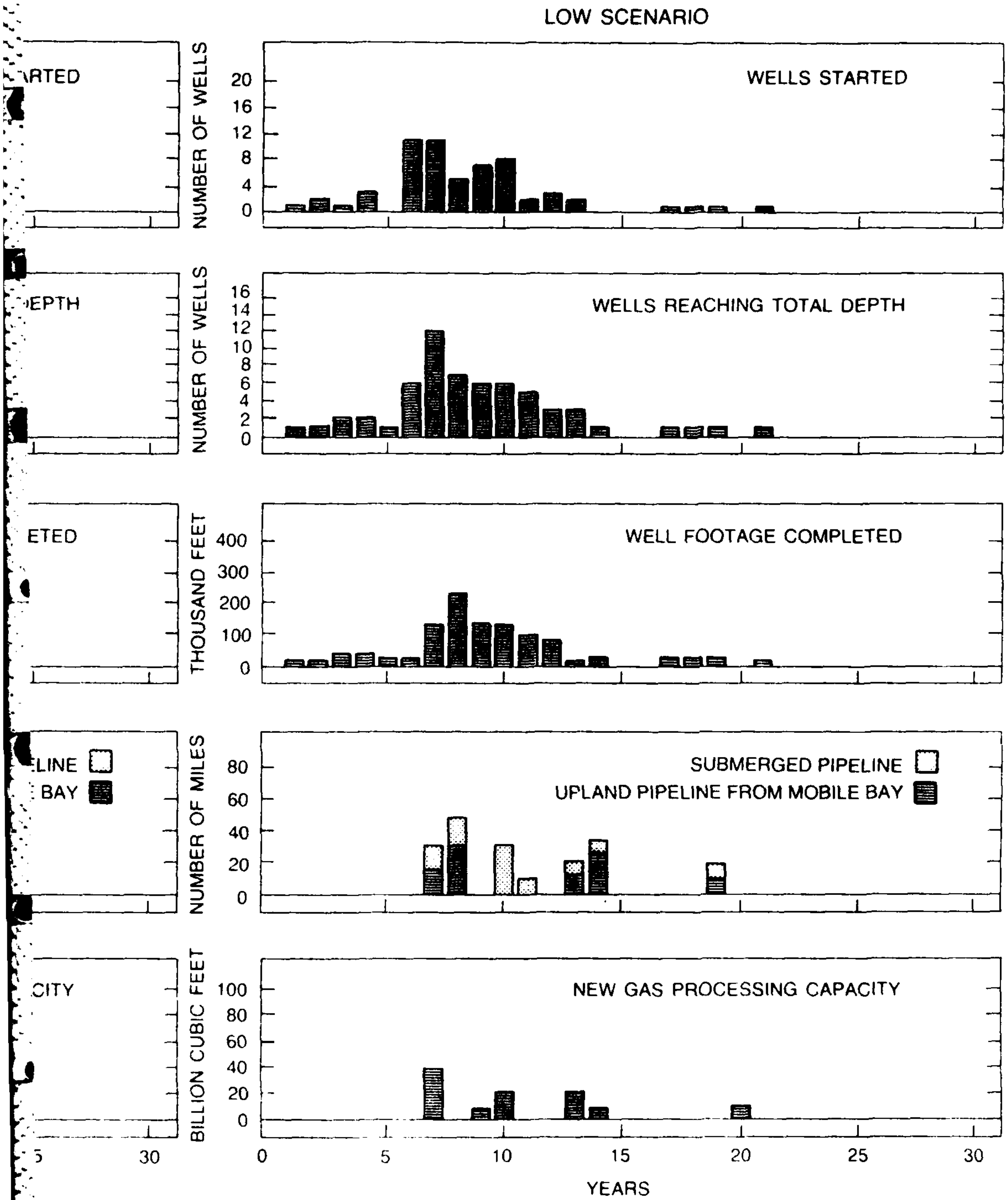
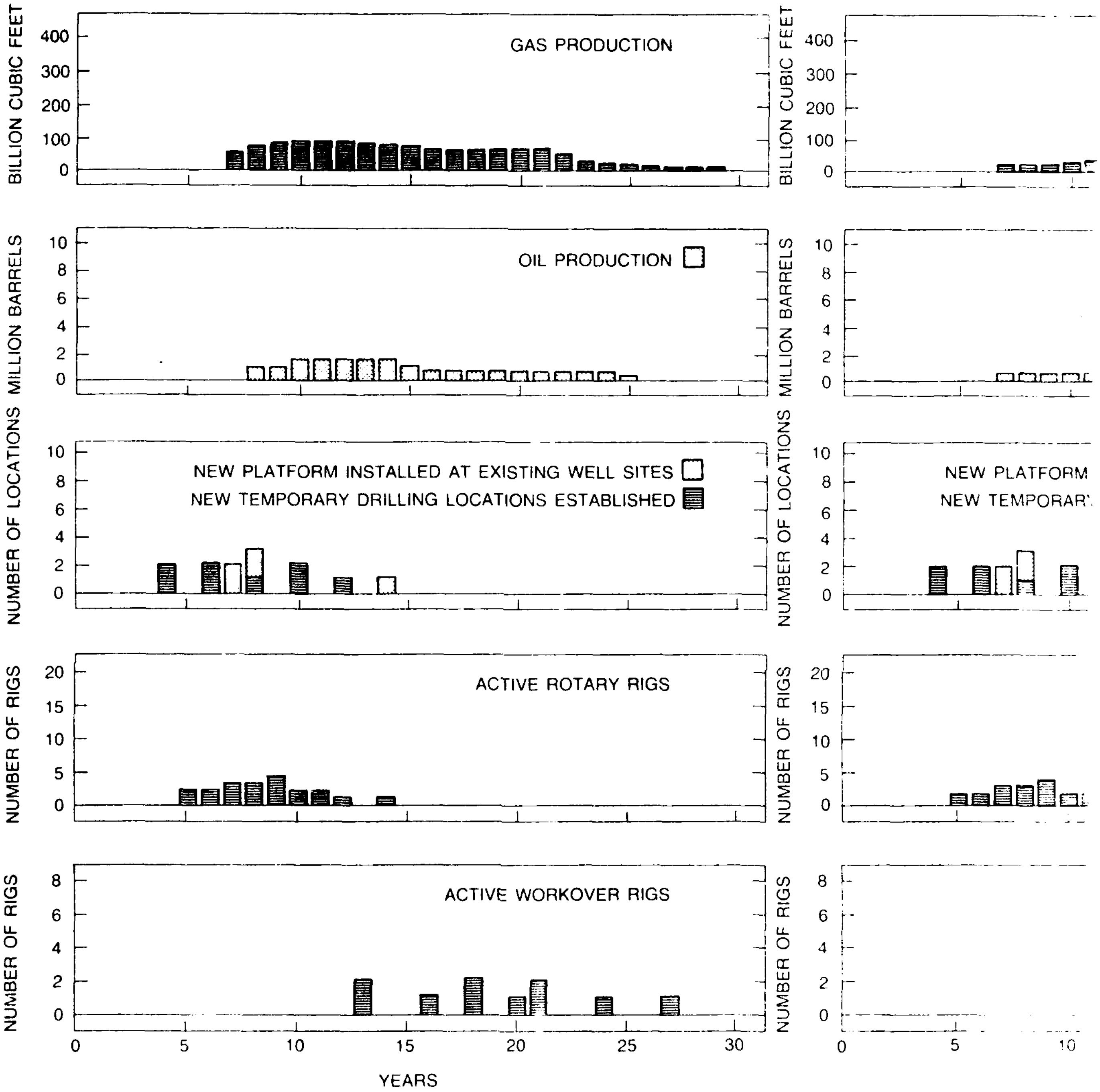
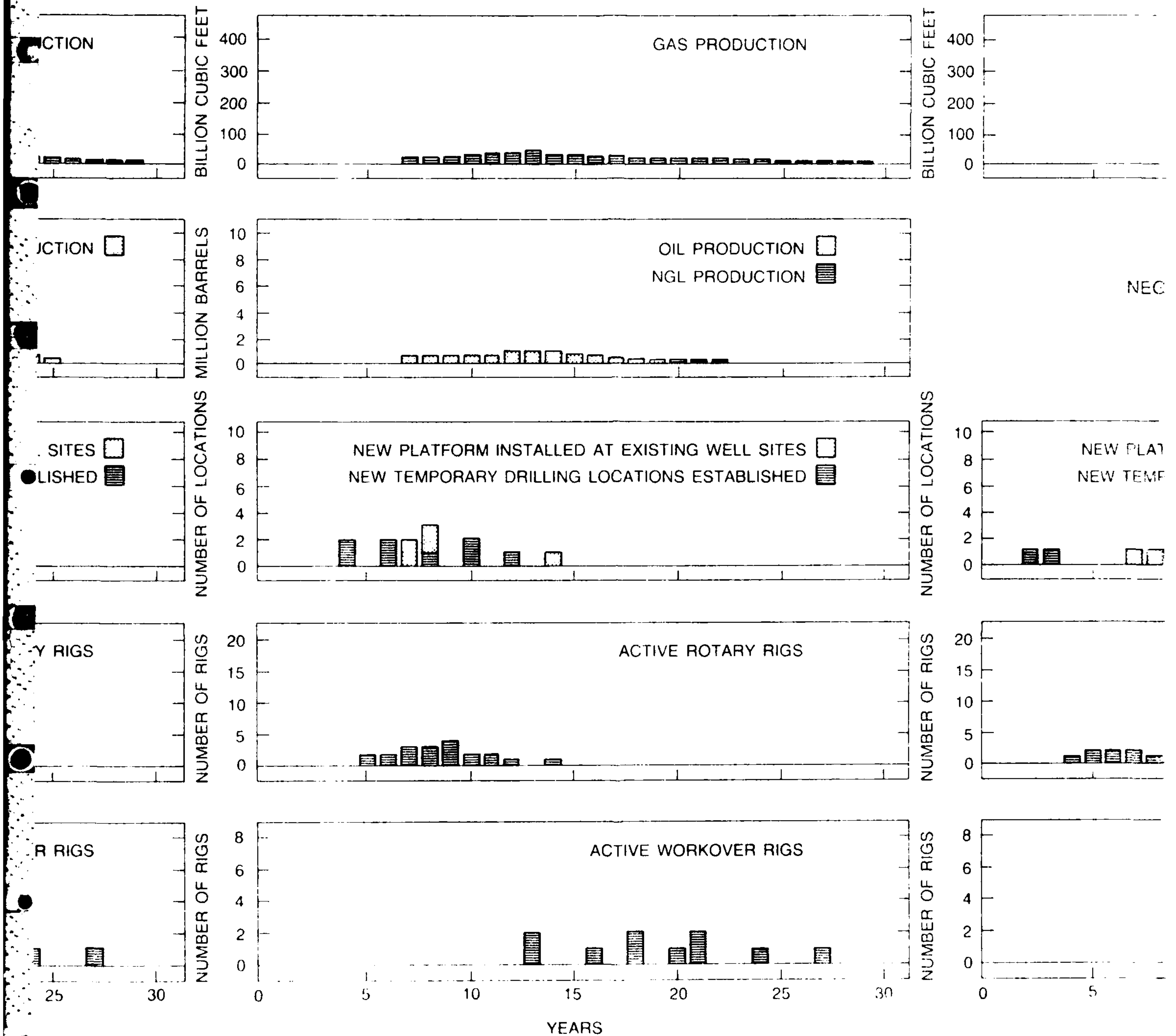


FIGURE 8-2
ACTIVITIES IN MOBILE BAY RESULTING FROM THE HYDROCARBON DEVELOPMENT SCENARIOS (CONTINUED)

HIGH SCENARIO



MODERATE SCENARIO



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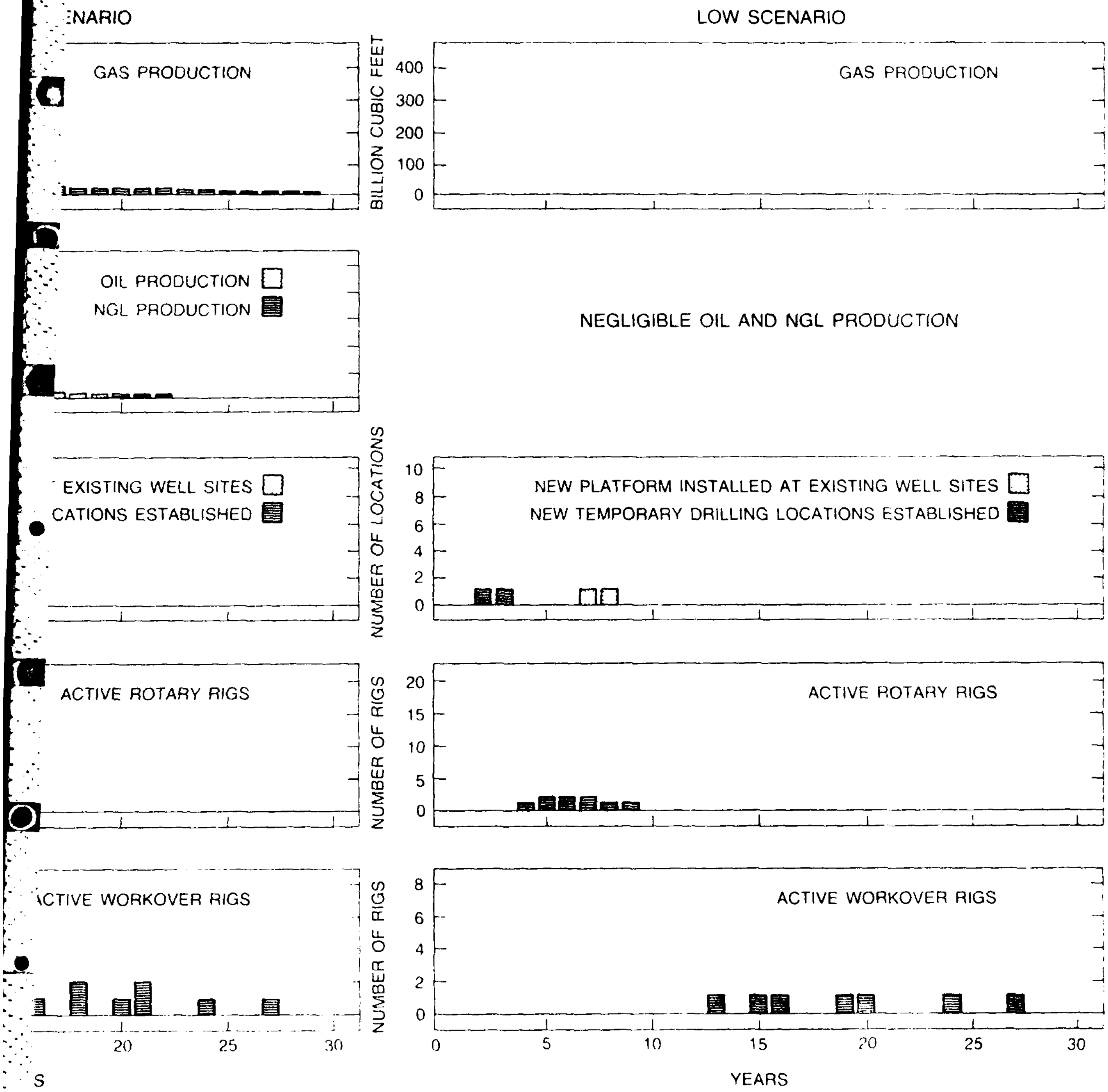
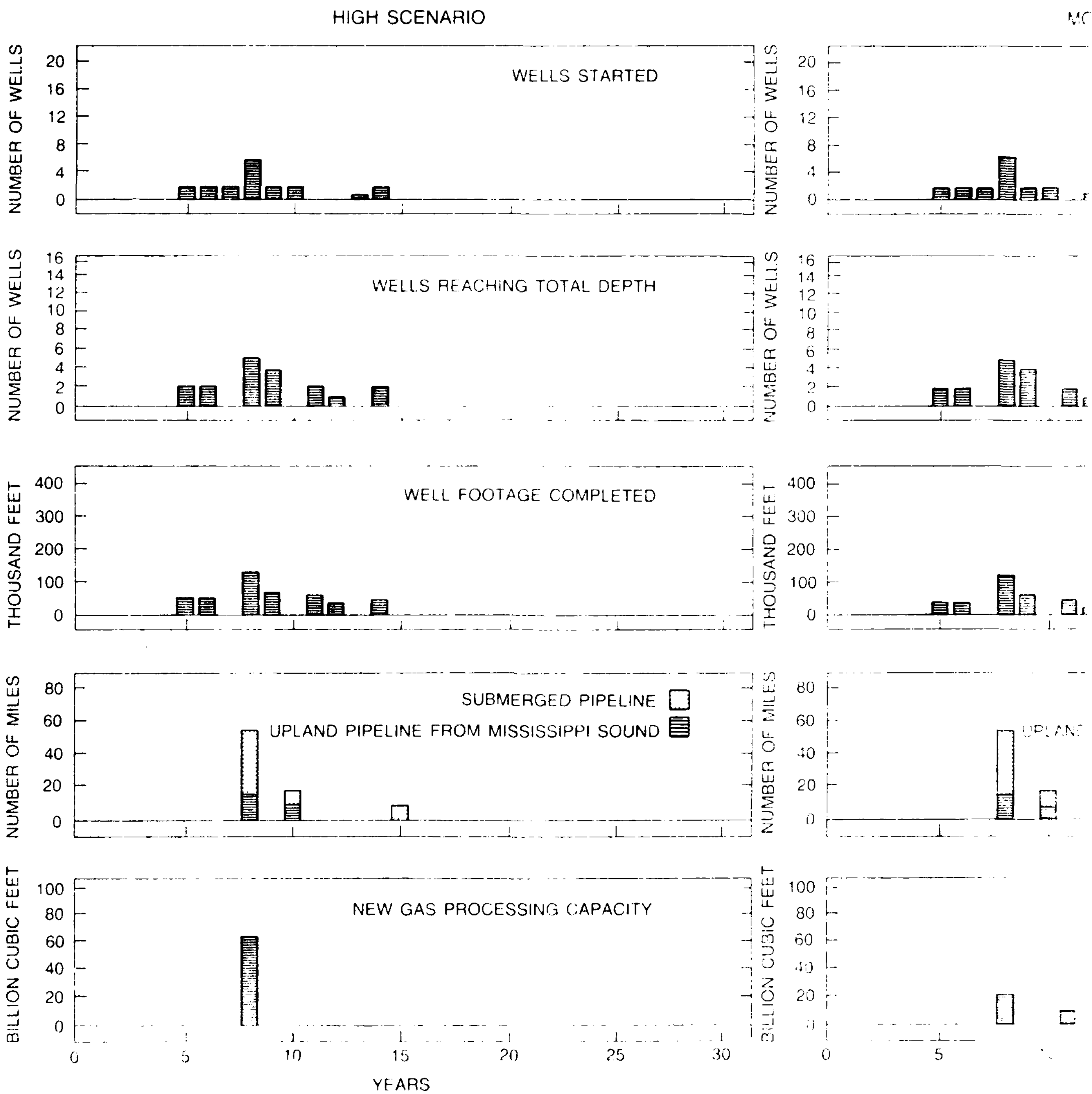
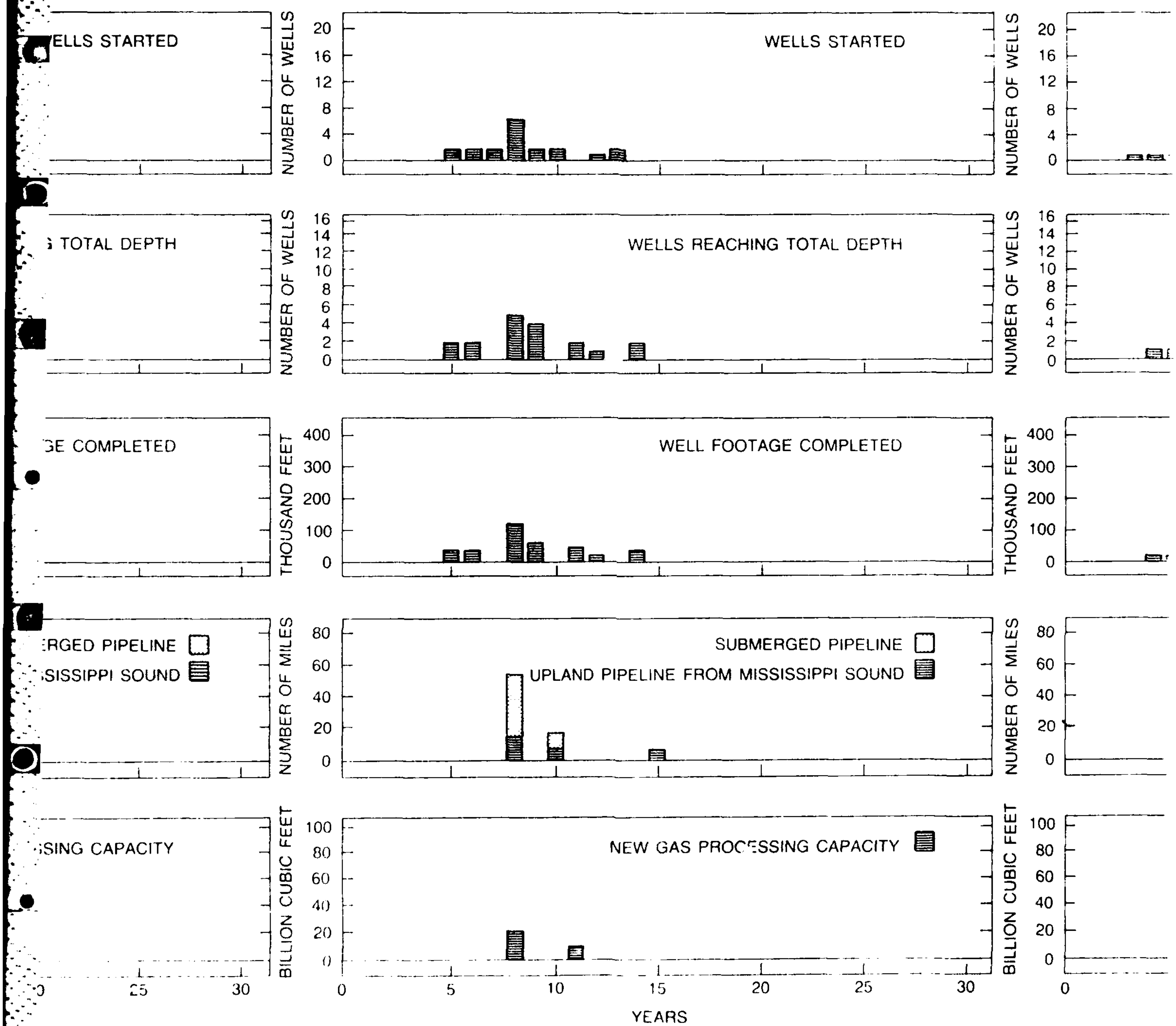


FIGURE 8-3
ACTIVITIES IN MISSISSIPPI SOUND RESULTING FROM THE HYDROCARBON RESOURCE DEVELOPMENT SCENARIOS



HIGH SCENARIO
WELLS STARTED
NUMBER OF WELLS
WELLS REACHING TOTAL DEPTH
WELL FOOTAGE COMPLETED
THOUSAND FEET
SUBMERGED PIPELINE
UPLAND PIPELINE FROM MISSISSIPPI SOUND
NUMBER OF MILES
NEW GAS PROCESSING CAPACITY
BILLION CUBIC FEET
YEARS

MODERATE SCENARIO



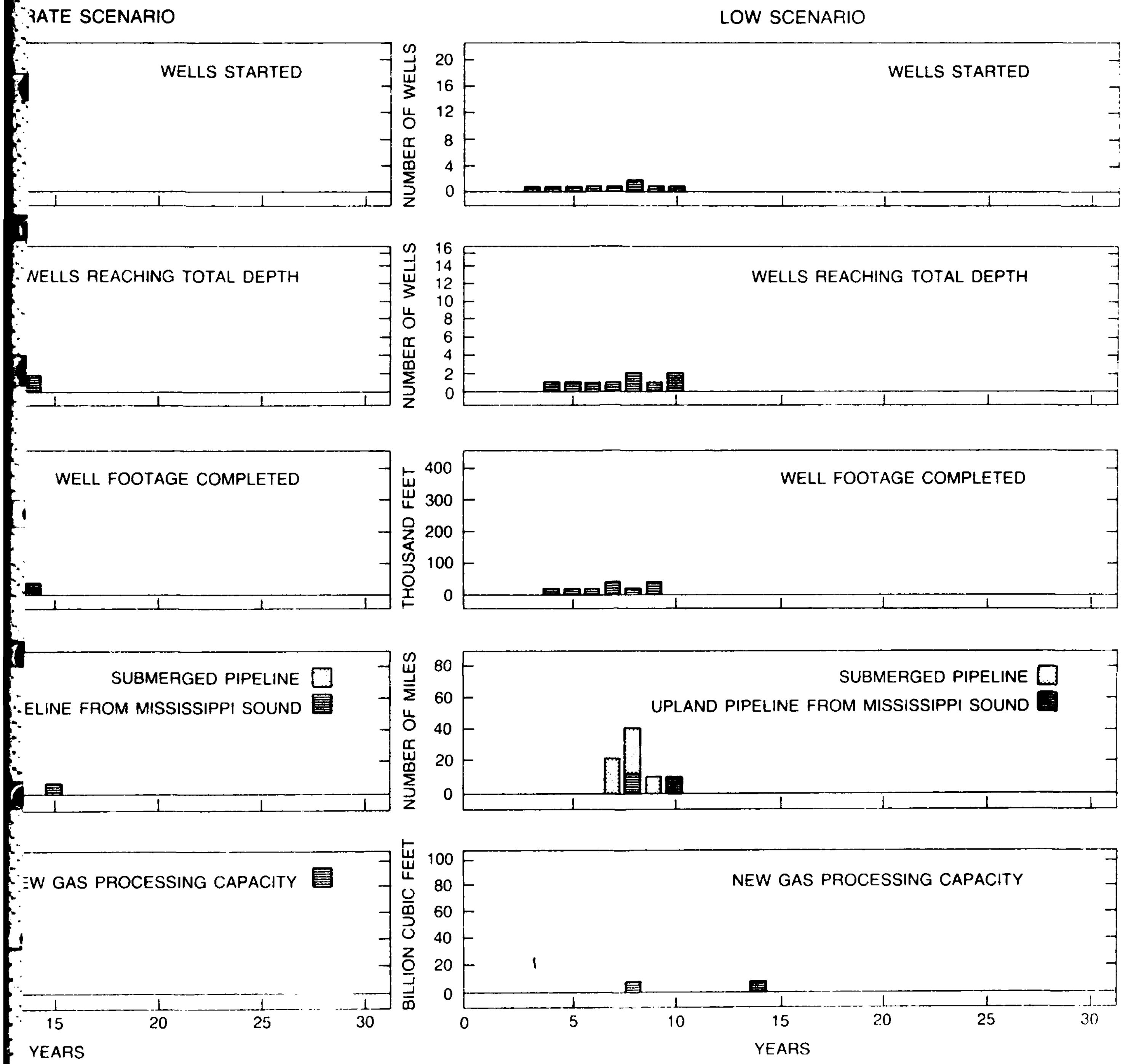
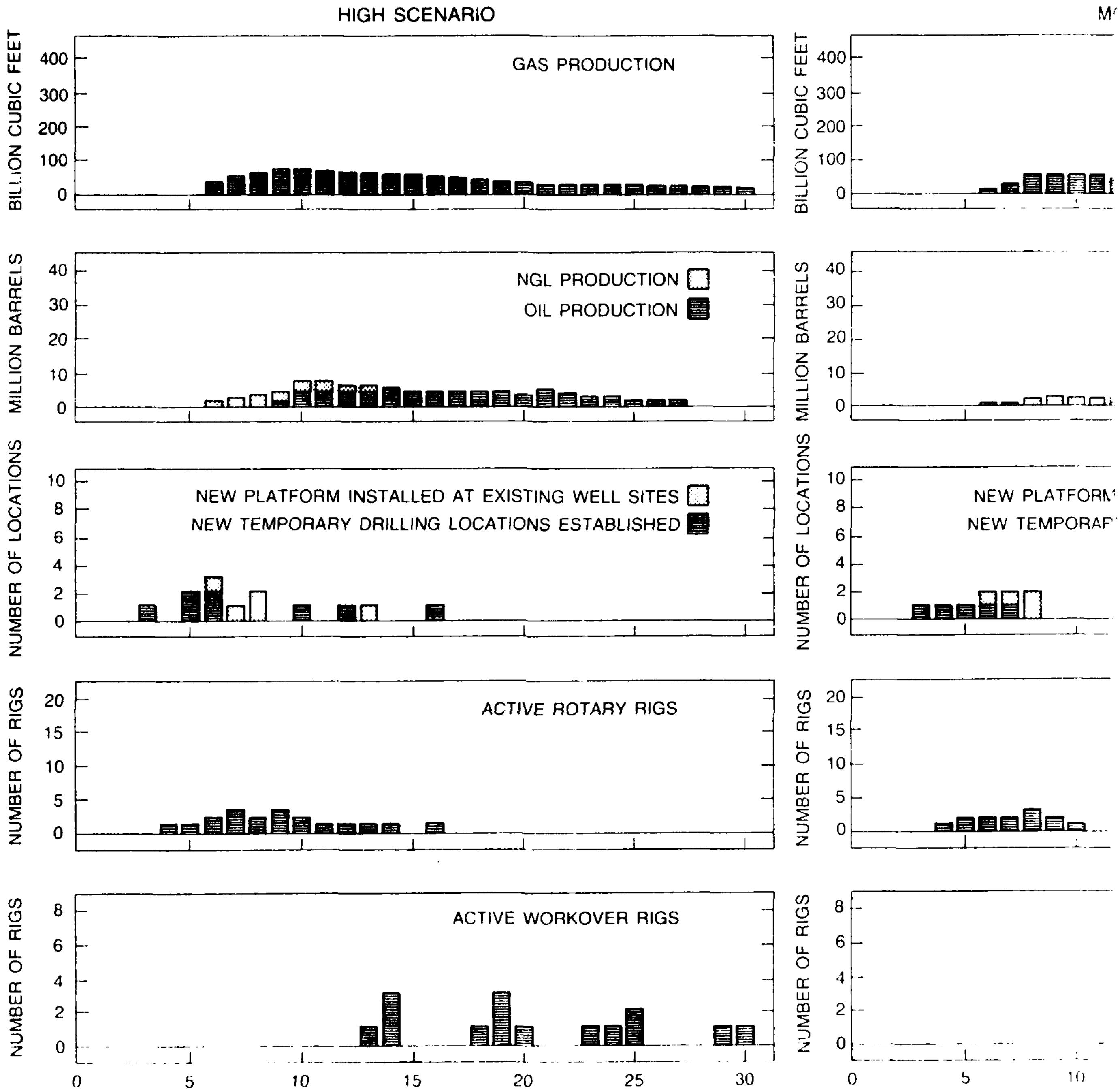
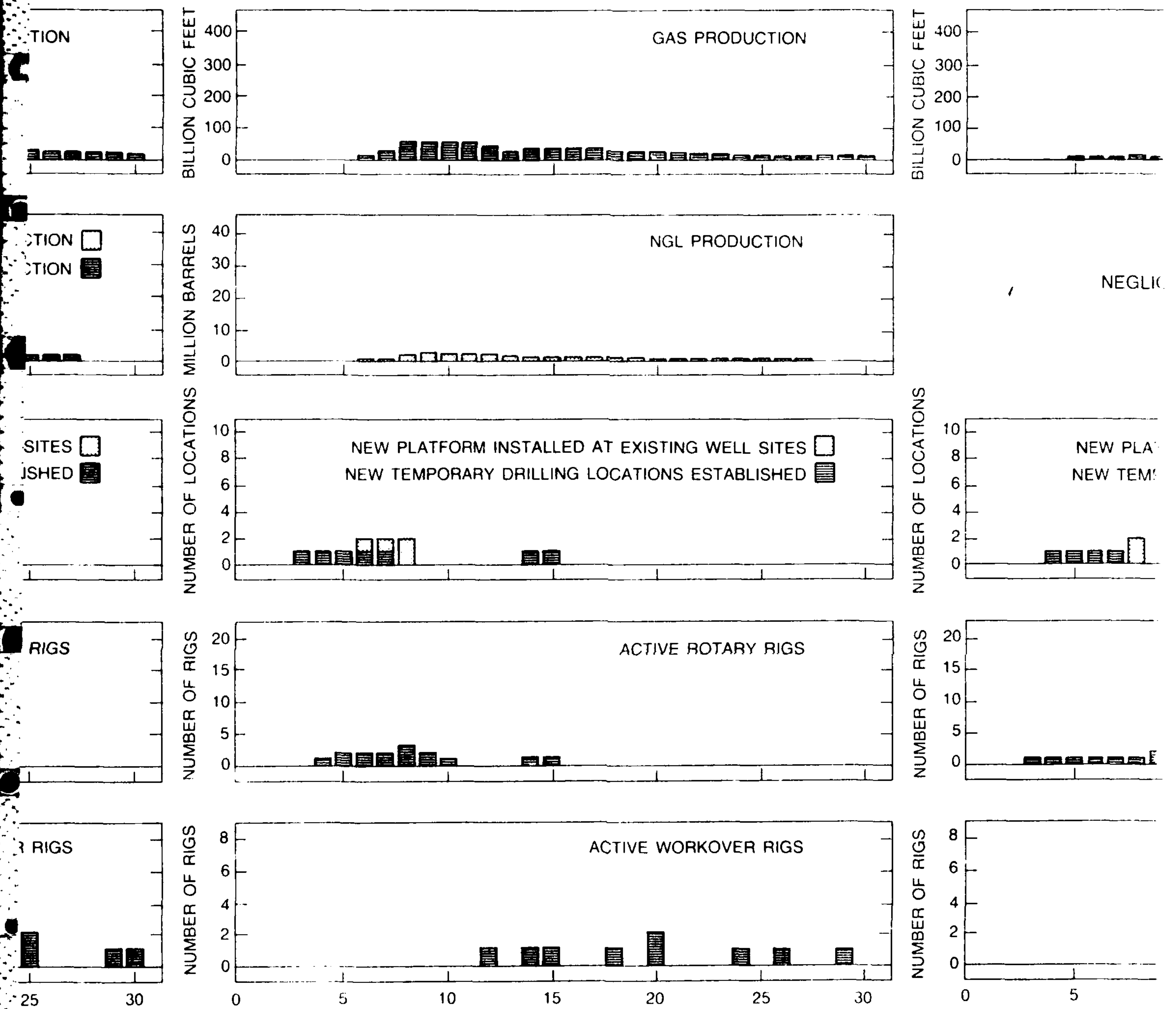


FIGURE 8-3
ACTIVITIES IN MISSISSIPPI SOUND RESULTING FROM THE HYDROCARBON RESOURCE DEVELOPMENT SCENARIOS (CONTINUED)



HIGH SCENARIO
GAS PRODUCTION
BILLION CUBIC FEET
NGL PRODUCTION
OIL PRODUCTION
MILLION BARRELS
NEW PLATFORM INSTALLED AT EXISTING WELL SITES
NEW TEMPORARY DRILLING LOCATIONS ESTABLISHED
NUMBER OF LOCATIONS
ACTIVE ROTARY RIGS
NUMBER OF RIGS
ACTIVE WORKOVER RIGS
NUMBER OF RIGS
0 5 10 15 20 25 30

MODERATE SCENARIO



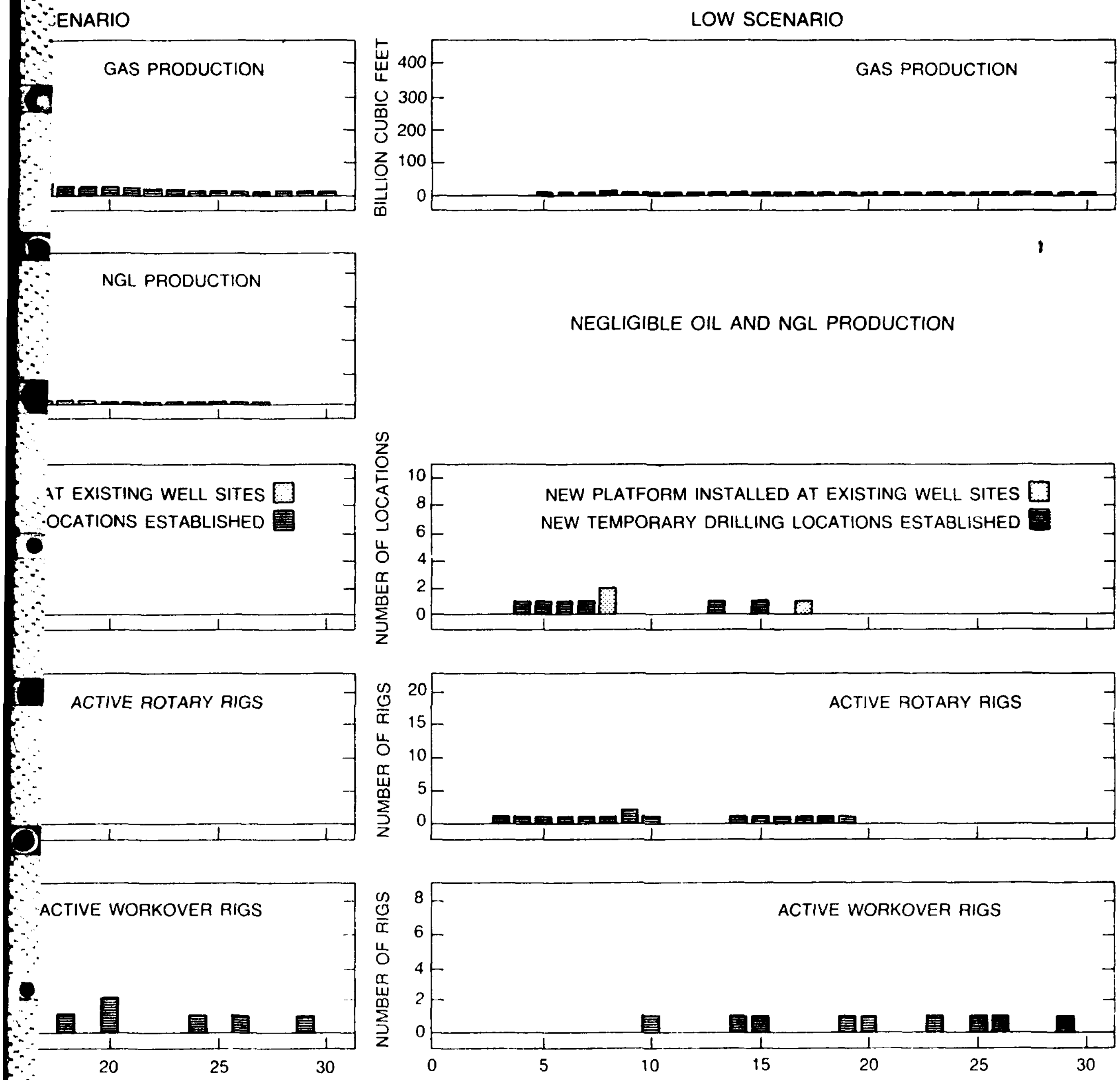
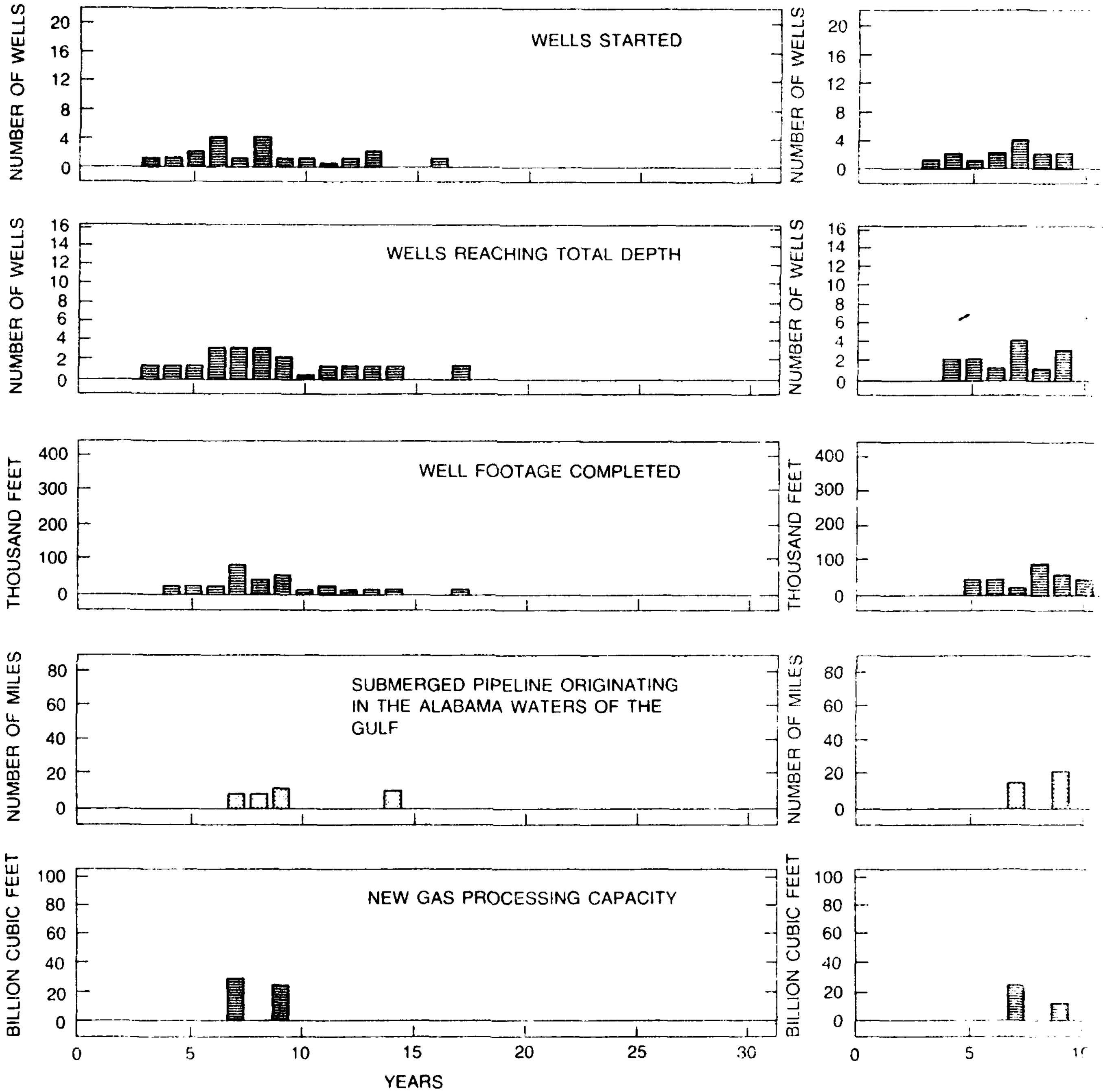
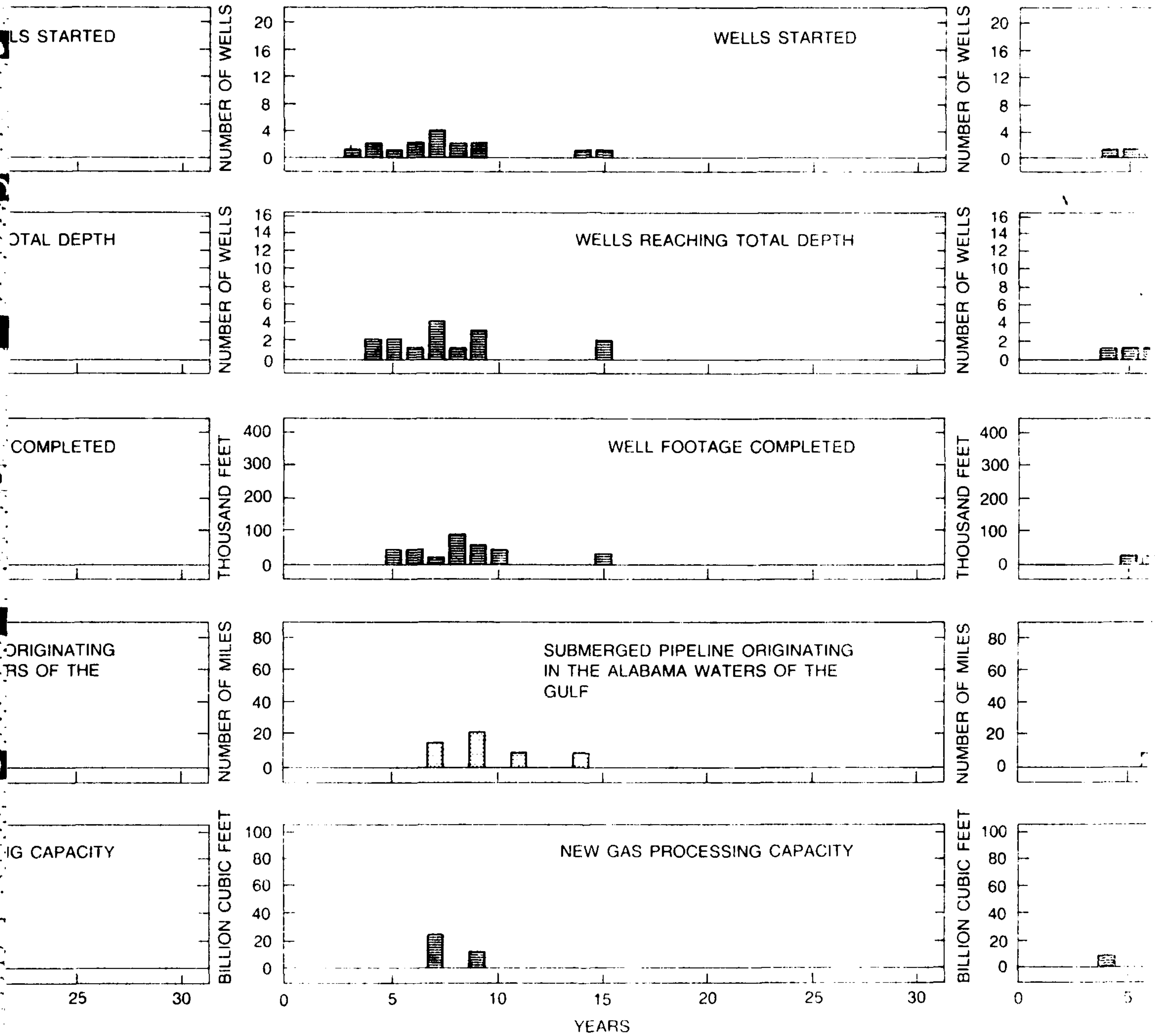


FIGURE 8-4
ACTIVITIES IN THE ALABAMA STATE WATERS OF THE GULF OF MEXICO RESULTING FROM THE HYDROCARBON RESOURCE DEVELOPMENT SCENARIOS

HIGH SCENARIO



MODERATE SCENARIO



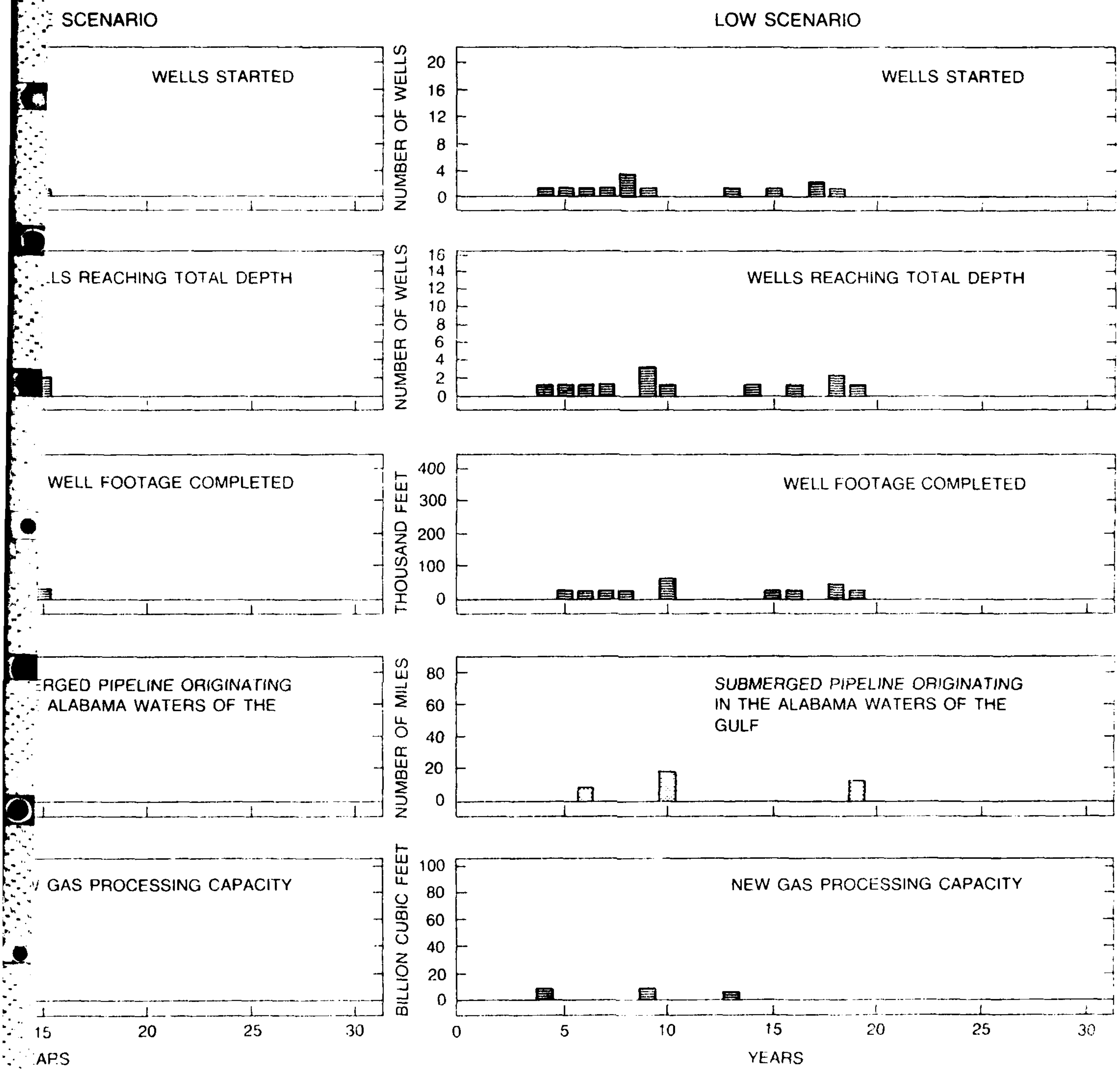
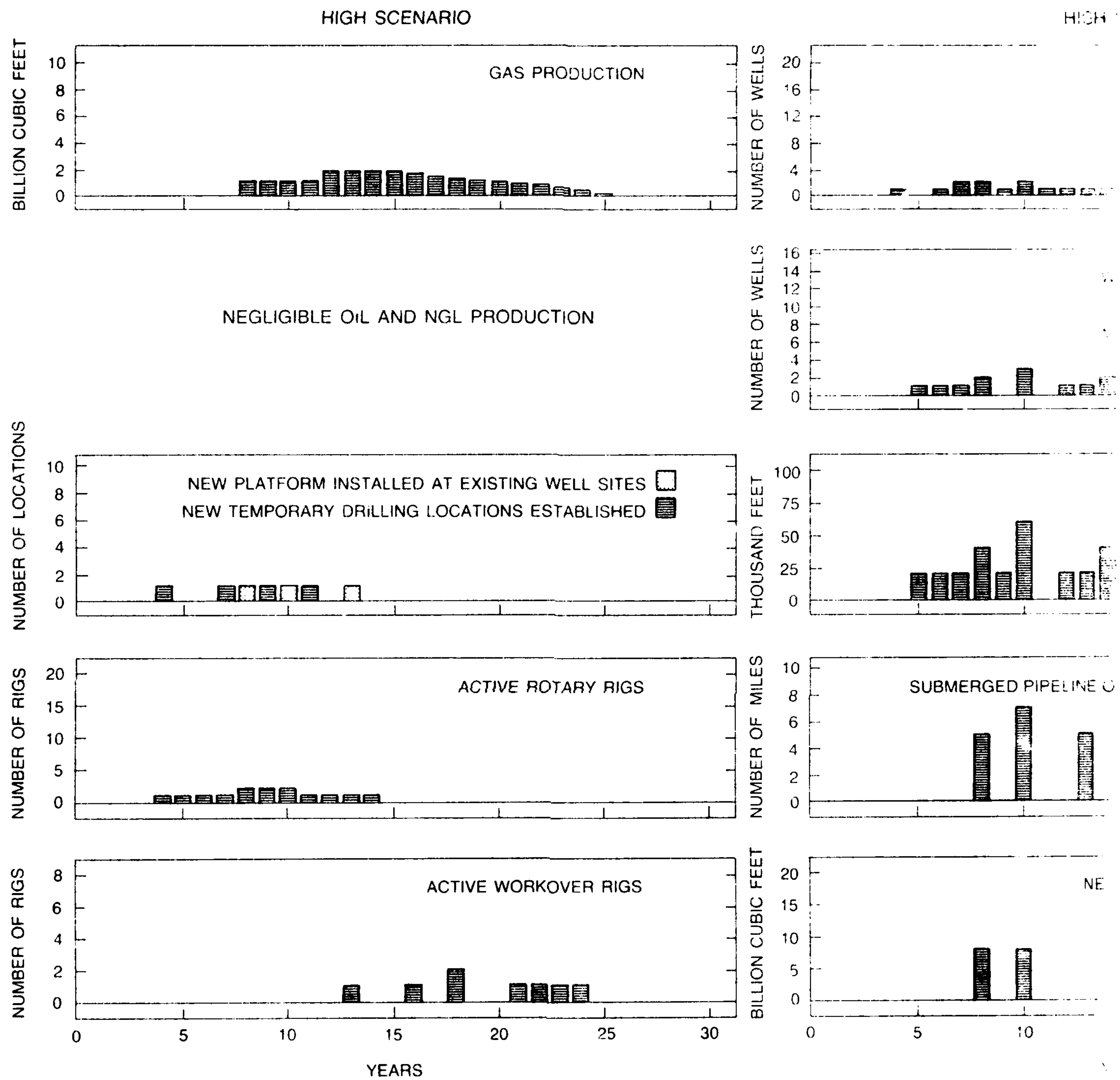
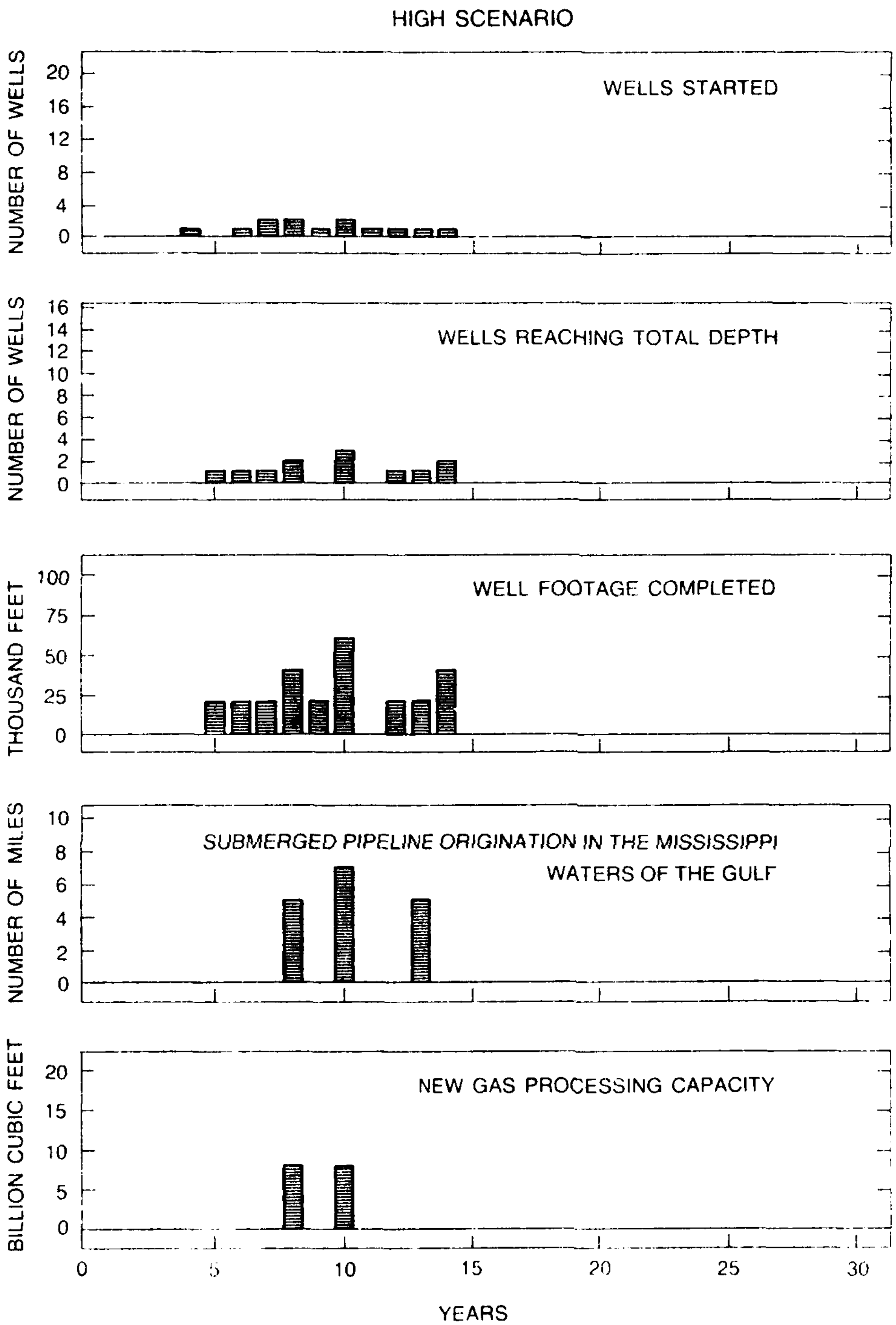


FIGURE 8-4
ACTIVITIES IN THE ALABAMA STATE WATERS OF THE GULF OF MEXICO RESULTING FROM THE HYDROCARBON RESOURCE DEVELOPMENT SCENARIOS (CONTINUED)

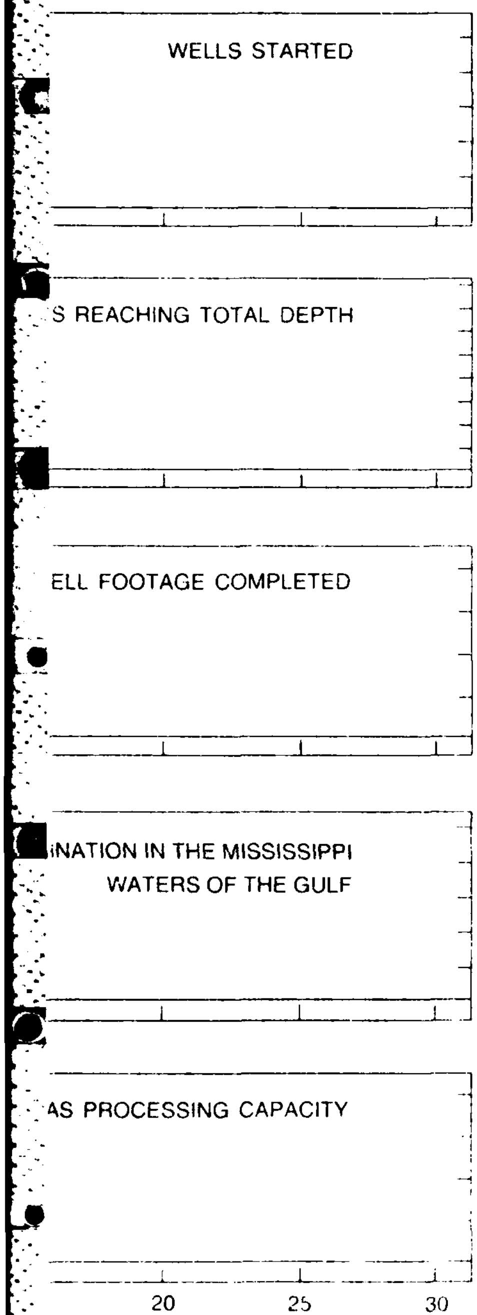
3



HIGH SCENARIO
GAS PRODUCTION
BILLION CUBIC FEET
NUMBER OF WELLS
NEGLIGIBLE OIL AND NGL PRODUCTION
NUMBER OF LOCATIONS
NEW PLATFORM INSTALLED AT EXISTING WELL SITES
NEW TEMPORARY DRILLING LOCATIONS ESTABLISHED
THOUSAND FEET
ACTIVE ROTARY RIGS
NUMBER OF RIGS
SUBMERGED PIPELINE
NUMBER OF MILES
ACTIVE WORKOVER RIGS
YEARS


HIGH SCENARIO
NUMBER OF WELLS
WELLS STARTED
NUMBER OF WELLS
WELLS REACHING TOTAL DEPTH
THOUSAND FEET
WELL FOOTAGE COMPLETED
NUMBER OF MILES
SUBMERGED PIPELINE ORIGINATION IN THE MISSISSIPPI WATERS OF THE GULF
BILLION CUBIC FEET
NEW GAS PROCESSING CAPACITY
YEARS

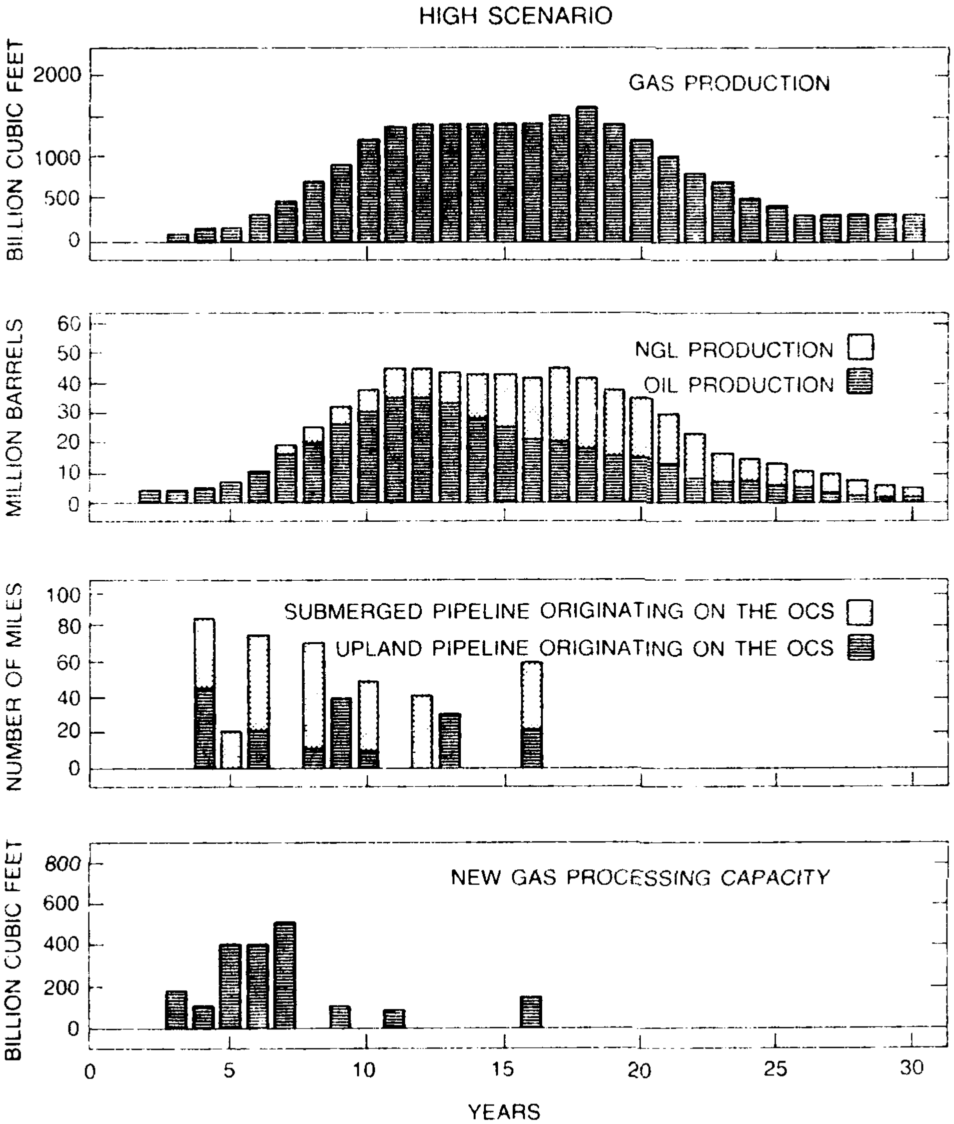
ENARIO

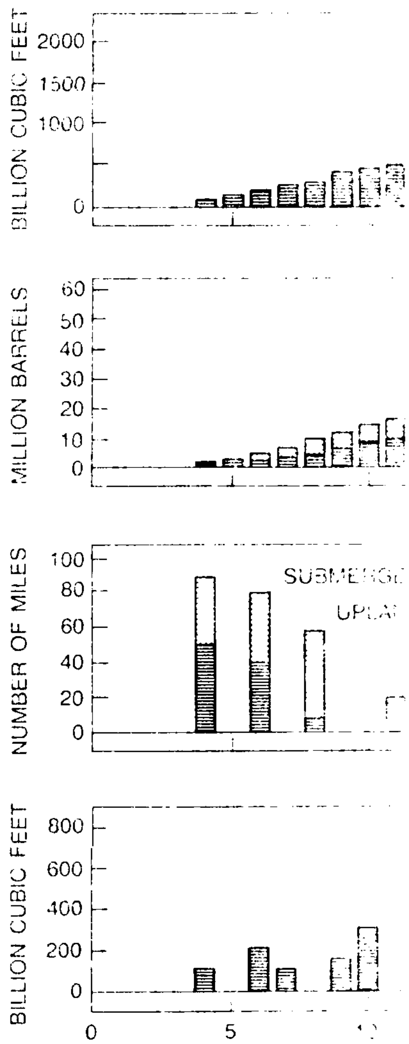


IS

NO ACTIVITY FOR MODERATE AND LOW SCENARIO

FIGURE 8-5
ACTIVITIES IN MISSISSIPPI STATE WATERS OF THE GULF OF MEXICO RESULTING FROM THE HYDROCARBON RESOURCE DEVELOPMENT SCENARIOS


HIGH SCENARIO
GAS PRODUCTION
BILLION CUBIC FEET
2000
1000
500
0
NGL PRODUCTION
OIL PRODUCTION
MILLION BARRELS
60
50
40
30
20
10
0
SUBMERGED PIPELINE ORIGINATING ON THE OCS
UPLAND PIPELINE ORIGINATING ON THE OCS
NUMBER OF MILES
100
80
60
40
20
0
NEW GAS PROCESSING CAPACITY
BILLION CUBIC FEET
800
600
400
200
0
0
5
10
15
20
25
30
YEARS


BILLION CUBIC FEET
2000
1500
1000
0
MILLION BARRELS
60
50
40
30
20
10
0
NUMBER OF MILES
100
80
60
40
20
0
BILLION CUBIC FEET
800
600
400
200
0
0
5

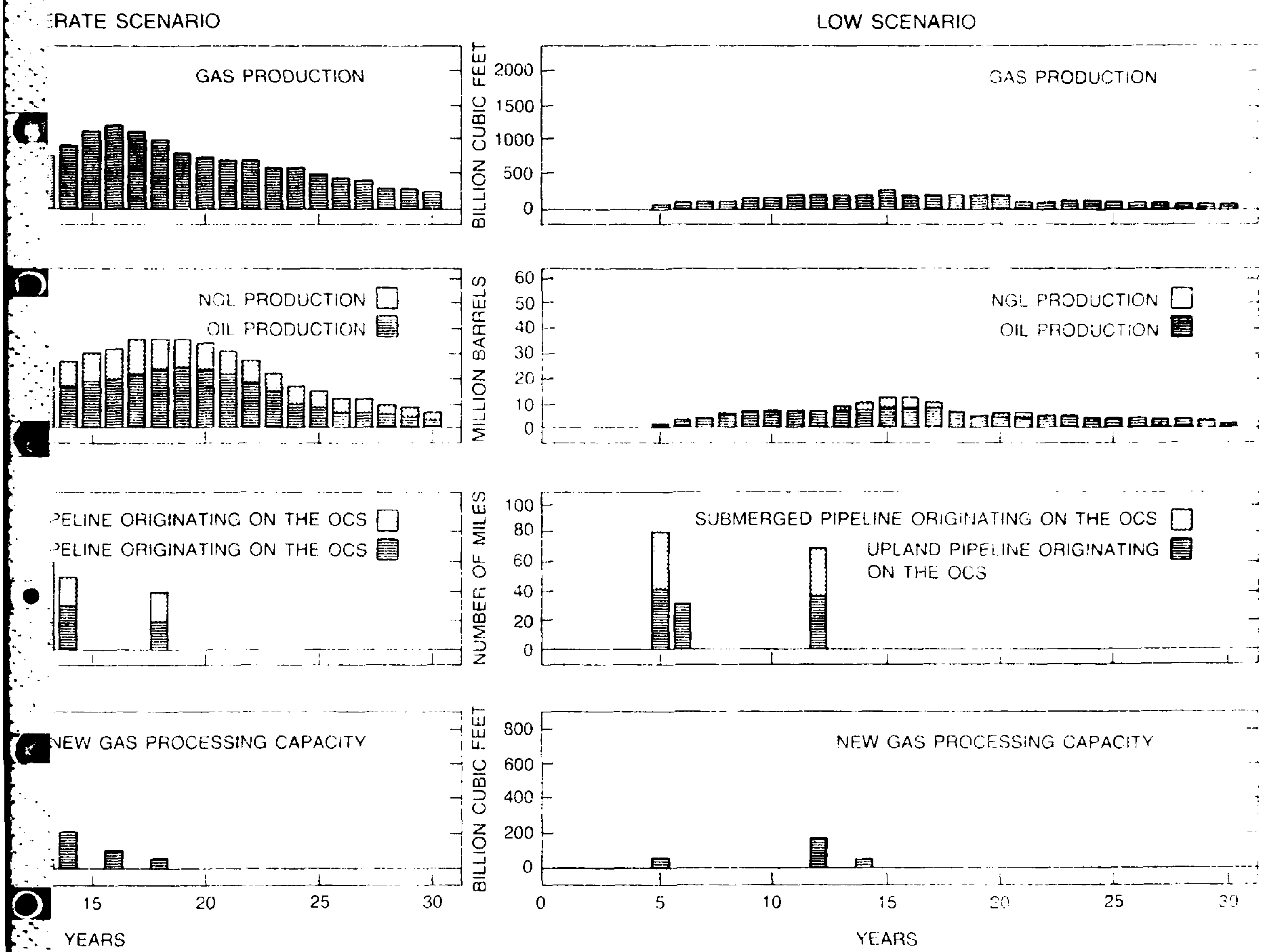
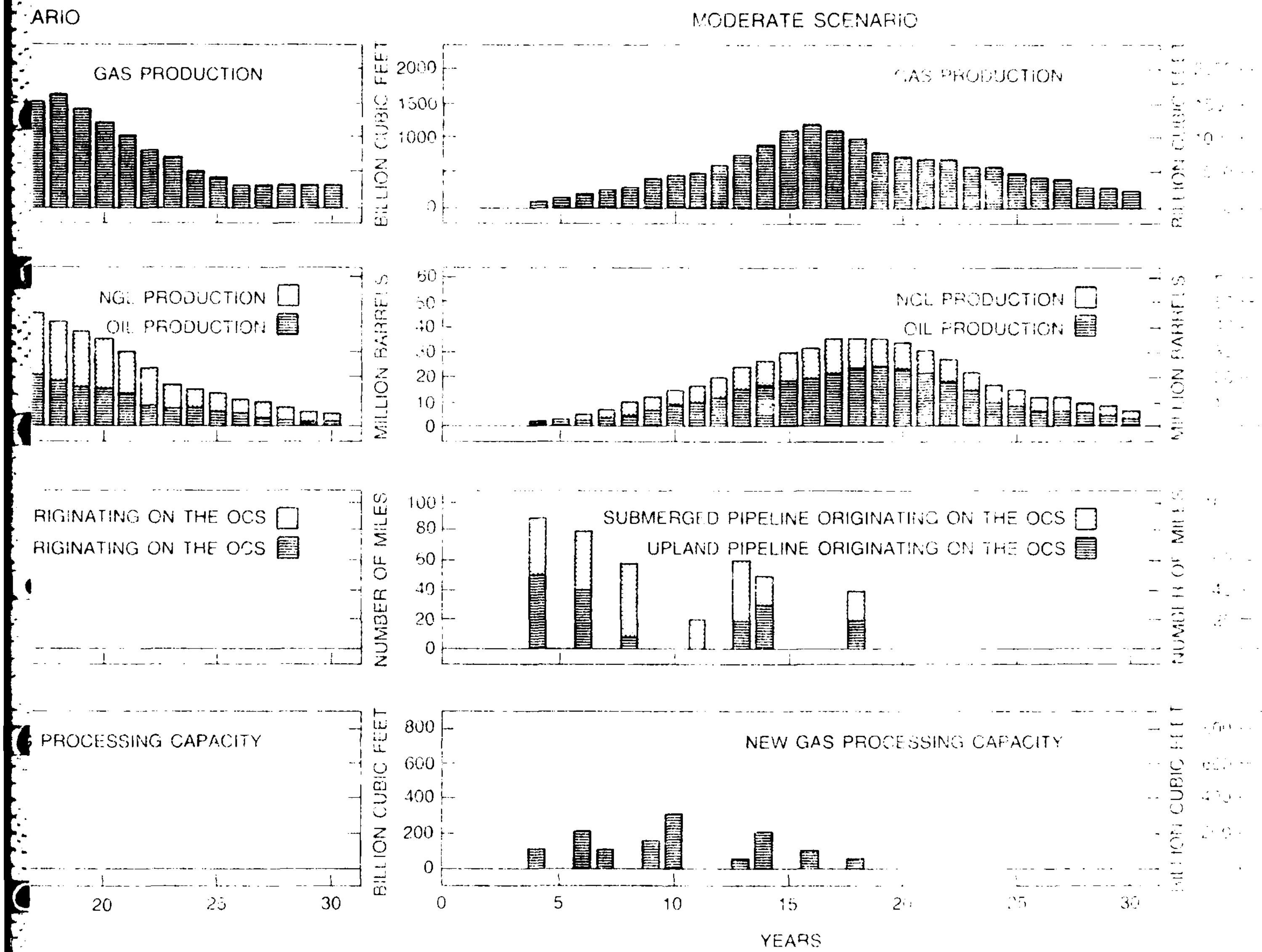


FIGURE 8-6
ACTIVITIES IN ADJACENT FEDERAL WATERS RESULTING FROM THE HYDROCARBON RESOURCE DEVELOPMENT SCENARIOS



ARIO
MODERATE SCENARIO
GAS PRODUCTION
BILLION CUBIC FEET
2000
1500
1000
0
NGL PRODUCTION
OIL PRODUCTION
MILLION BARRELS
60
50
40
30
20
10
0
RIGINATING ON THE OCS
RIGINATING ON THE OCS
SUBMERGED PIPELINE ORIGINATING ON THE OCS
UPLAND PIPELINE ORIGINATING ON THE OCS
NUMBER OF MILES
100
80
60
40
20
0
PROCESSING CAPACITY
NEW GAS PROCESSING CAPACITY
800
600
400
200
0
20
25
30
0
5
10
15
YEARS

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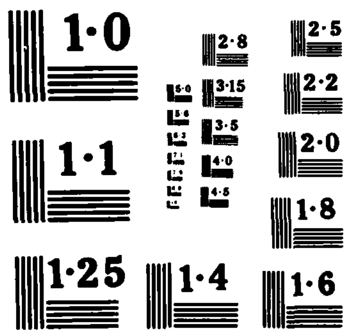


NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

CHAPTER 9

CUMULATIVE IMPACTS

9.1 The effects of the postulated levels of hydrocarbon development would represent an incremental increase in the effects of human activities in the study area. There are two broad categories of activities in the study area that could also produce environmental effects: a) current, long-term projects and; b) planned activities that can occur during the time-frame of this study.

Effects in Conjunction with Other Current Activities in the Study Area

9.2 There are a variety of other activities occurring in Alabama and Mississippi coastal waters that involve the disturbance of benthic communities and the generation of turbidity as would the postulated drilling and production activities. These activities are mainly channel maintenance dredging projects but also include shell dredging and trawling operations.

9.3 Dredging activities in the region are extensive and annually disturb considerably more benthic habitat than the proposed drilling and production activities. Maintenance dredging and disposal of material is required in the system of navigation channels in the region. Table 9-1 presents a list of the federally maintained channels in the region and an approximate frequency of maintenance dredging activities. Since 1971, approximately 13.5 million cubic yards of material have been dredged annually from navigation channels in the study area (U.S. Army, Corps. of Engineers, 1983b). About equal amounts of material are dredged from channels in Mobile Bay (including Mobile Harbor and associated channels) and from channels in Mississippi Sound. Currently, no channel dredging is required in the federal channels in the Mobile Delta above the port of Mobile due to the depths of the natural channels.

9.4 Oyster shells are mined hydraulically in large quantities from upper Mobile Bay and its tributaries, primarily for use in the manufacture of cement, with other uses including masonry block, poultry feed supplements, chemicals, and road or foundation materials. Such operations can produce large depressions in the bottom of the Bay when thick deposits of oyster shell are removed. In 1979, Alabama was ranked third nationally in the production of oyster shell, with an annual production of about 1 to 1.5 million cubic yards (Friend et al., 1982; U.S. Army, Corps of Engineers, 1983b).

TABLE 9-1

MAINTENANCE DREDGING FREQUENCY
OF NAVIGATION CHANNELS IN PROJECT AREA

Navigation Channel	Approximate Dredging Frequency
Major Channels	
Gulf Intracoastal Waterway	Every 2 years
Mobile Bay Channel	Every 2 years
Mobile Harbor Channels and Turning Basins	Every 2 years
Theodore Ship Channel	Every 2 years
Bayou Casotte Channel	Yearly
Pascagoula Harbor Channel	Yearly
Biloxi Harbor Channels	Every 2 years
Gulfport Harbor Channels	Yearly
Smaller Channels	
Pass Christian Harbor and Channel	Every 5 years
Bon Secour River Channel	Every 5 years
Dog and Fowl River Channels	Every 2 years
Fly Creek Channel	Every 5 years
Dauphin Island Channels and Anchorage Basins	Every 5 years
Bayou Coden Channel	Every 3 years
Bayou La Batre	Every 3 years
Wolf and Jordan River Channels	Every 3 years
Cadet Bayou Channel (Bayou Caddy)	Every 3 years

Source: U.S. Army, Corps of Engineers, 1982c.

9.5 Shrimp are the primary target for the trawling operations. However, outside of the shrimp season, the otter trawls are used to harvest a variety of finfish (See commercial fisheries sections in previous chapters, particularly Chapter 3). Such trawling activities can produce considerable turbidity in the trawling area.

9.5a The cumulative effect of oil and gas related activities resulting in turbidity would depend on such factors as the quantity of the activities occurring at one time, the proximity of concurrent activities to each other, and the proximity of activities to turbidity-sensitive areas such as oyster reefs. While the turbidity-generating activities associated with oil and gas development could be a small contribution to the total turbidity contributed to the waters of the study region, an individual activity could have significant effect if a turbidity sensitive area were affected.

9.6 Within the Mobile Delta, an on-going activity that produces a variety of habitat disturbances is timber harvesting. Timber production from the Delta has been occuring since before the turn of the century. Since the development of the pulp and paper industry in 1910-1930, pulpwood has been the primry product of area timbering (Friend et al., 1982).

9.7 In connection with the recent construction of the Theodore Ship Channel in Mobile Bay, a large diked disposal island was established to accommodate material dredged during construction and material that will be dredged in future maintenance operations.

Additional Future Activities

9.8 Several proposed activities in the study area could also produce a variety of environmental disturbances. These activities include:

- deepening of Mobile Ship Channel and Mobile Harbor,
- construction of the Theodore wastewater outfall,
- completion of the Tennessee - Tombigbee waterway.

Other activities that are under investigation include the deepening and widening of the Pascagoula Harbor Channel and the Gulfport navigation channel.

9.9 If the proposal to deepen the Mobile Ship Channel to 55 feet is implemented, over 125,000,000 cubic yards of material would be dredged and disposed of. Of this, 63.4 million cubic yards would

be excavated in the upper bay and could be used to create 1,047 acres of fast land in Mobile Bay adjacent to the Brookley waterfront. The disposal of material on Blakely Island is also under consideration. An additional 58,700,000 cubic yards of material from the lower bay could be disposed of at a disposal site in the Gulf of Mexico to be designated by the U.S. Environmental Protection Agency.

9.10 If the proposed deepening project is implemented, the dredged material from future maintenance dredging would also be disposed of offshore and this would eliminate the turbidity now produced by disposal at spoil areas within the Bay.

9.11 Construction of the proposed Theodore wastewater outfall would require the laying of a 4-mile long pipeline in central Mobile Bay. The discharge of up to 20,000,000 gallons per day of treated industrial wastewater and 5,000,000 gallons per day of secondarily treated domestic wastewater would occur.

9.12 While the Tennessee - Tombigbee waterway project does not involve any major dredging or construction activities in the study area, its completion could affect activities in the area. The completion of this waterway would produce significant increases in waterway traffic in the area, particularly, on the Mobile River.

9.13 The District is currently formulating a long-term plan for the disposal of dredged material from federal channels in Mississippi Sound and for alternative disposal areas for dredged material from Mobile Harbor.

9.14 Another source of environmental modification throughout the area is the increase of urban and industrial development. If adequate control measures are not instituted, such development can increase the sediment and nutrient load entering area waterways from these non-point source activities.

9.15 Detailed information on the other activities can be found in a number of documents, particularly the various environmental impact statements prepared for the area. These documents include the following environmental reports in the GEIS reference list: U.S. Army Corps of Engineers, 1973, 1975b, 1977, 1979a, 1984a, 1984b; U.S. Environmental Protection Agency, Region IV, 1978; U.S. Environmental Protection Agency, State of Alabama, and U.S. Army Corps of Engineers, Mobile District, 1973.

CHAPTER 10

MITIGATING MEASURES

INTRODUCTION

10.1 The postulated levels of hydrocarbon development in coastal Alabama and Mississippi would have a variety of environmental effects as detailed in Chapter 8. In the case of many of the undesirable effects, the degree or severity depends in large measure on what concurrent actions are taken to minimize or offset the adverse effects. A variety of possible mitigating measures are available for the different phases of hydrocarbon development. Table 10-1 (end of chapter) lists the various mitigating measures under three broad categories:

- o Regulatory requirements.
- o Industry practice.
- o Other potential mitigation practices.

Under these categories, mitigating measures are listed for the various subcategories of the physical, biological or socioeconomic environment that would be potentially affected by development activities.

REGULATORY REQUIREMENTS

10.2 This category includes those measures required by federal, state and local laws and regulations pertaining to hydrocarbon development specifically or to related activities in a particular environment. For example, the state oil and gas boards have specific bore hole casing requirements to protect groundwater resources.

10.3 With regard to accident conditions, Section 311 of the Clean Water Act is a set of provisions which apply to the discharge of oil or hazardous substances to navigable surface waters or adjoining shorelines or if a threat of such a discharge exists. Certain emergency response provisions are not utilized if the determination is made that the substance(s) would be properly controlled by the discharger. Federal activities are conducted based on the National Oil and Hazardous Substances Pollution Contingency Plan developed by the U.S. Environmental Protection Agency. This national plan establishes an inter-agency national response team, regional response teams, and an on-call National Strike Force which are identified in each contingency plan prepared by an applicant. Pollution control activities in the study area are

supervised for coastal and inland areas by on-scene coordinators appointed by either the U.S. Coast Guard (below I-65) or the U.S. EPA (above I-65).

10.4 Failure to notify the Federal government immediately of a discharge is considered a criminal offense. A $35 million revolving fund administered by the U.S. Coast Guard finances Section 311 activities and is applied to cases where the responsible party is not taking appropriate action.

10.5 The U.S. EPA administers the national contingency plan to prevent oil discharges from onshore and offshore drilling, producing, gathering, storing, processing, refining, or distributing facilities. Procedures, methods and equipment requirements for owners or operators of oil facilities must be established. Water transportation-related facilities are under U.S. Coast Guard authority rather than under EPA authority. Under EPA authority, Spill Prevention Control and Countermeasure (SPCC) Plans must be prepared by either the owner or operator. All mobile or portable rigs and fuel facilities must have an approved SPCC Plan prepared in accordance with federal guidelines (40 CFR 112.7). Mobile or portable rigs include onshore drilling or workover rigs and barge-mounted drilling or workover rigs.

10.6 The Gulf Coast strike team (U.S. Coast Guard) is located in Bay St. Louis, MS and is equipped to contain and clean-up oil in a variety of inshore and offshore conditions within hours of spill notification. Relocation of the team to Mobile, Alabama is scheduled for the fall/winter of 1984/85. The cost of any actions taken by the team are the responsibility of the responsible party.

10.7 The Mississippi Department of Natural Resources, Bureau of Pollution Control, also has an Emergency Services Section which consists of two full-time persons and one half-time supervisor. The Mississippi 305(b) report for 1982 (Mississippi Department of Natural Resources, 1982) indicates that this small section has had a very positive effect on mitigating spills of hazardous substances throughout the state. Private companies responsible for particular spills usually provide equipment, personnel, and finances needed to provide an adequate clean-up. If private companies do not provide adequate resources, the Bureau of Pollution Control has a Pollution Abatement Grant Fund utilized to pay private clean-up contractors. Following a contracted clean-up, litigation is requested to recover utilized state funds. Two such contracted clean-ups were needed in Missisisppi during a 12-month period of 1981-1982. Usually, contractors are needed when proof of the source of a spill is questionable; such spills are particularly likely to occur in state waters where more than one potential source of spills is located in close proximity to each other.

10.8 The Mobile Oil Corporation has developed an emergency action plan for four hydrocarbon wells in Mobile Bay (U.S. Army Corps of Engineers, 1980). The basic elements of this emergency action plan are as follows:

- Emergency coordination: responsibilities, duties, lines of authority, lines of communication;
- Three areas covered by the plan are operation failure, hazardous discharges, and natural disasters such as hurricanes;
- Hurricane plan: readiness for evacuation, plug in wellbore, blowout preventors closed, rig secural or rig relocation, four blowout preventors per well, and periodic equipment testing;
- Well control task force implemented in case of loss of well control;
- Spill task force with central and field posts;
- Pollution barge with control and clean-up equipment would be located in vicinity when spill task force is implemented; and
- Spill monitoring plan approved by ADEM is included.

INDUSTRY PRACTICE

10.9 In this category are various practices which the oil and gas industry generally follow in the various phases of development of oil and gas resources (Table 10-1, end of chapter). For example, companies employ a variety of practices and equipment to maintain safe operating conditions when drilling into formations with high hydrogen sulfide concentrations. One set of industry practices are not summarized in this chapter but are included in the Bibliography. These are the various Recommended Practices and the Specifications published by the American Petroleum Institute (API), such as the API Recommended Practices for Safe Drilling of Wells containing Hydrogen Sulfide (American Petroleum Institute, 1974b, 1981a) and API Specification for Materials and Testing of Well Cements (American Petroleum Institute, 1982c).

10.10 Various methods for designing and constructing a canal or slip, for installing pipelines in wetlands and for installing pipelines across (or beneath) river channels are available. For example, watertight dredging buckets generate 30 to 70 percent less turbidity than do more typical buckets or clamshells (Barnard, 1978). A number of industry practices to prevent spills and to

control impacts of noise, wastewater and solid wastes as well as impacts on groundwater, air quality, the local ecosystem and the local economy are also available (see Table 10-1, end of chapter). Specific measures not listed in this chapter could be required by a state or Federal agency in the future. The reader is referred to Chapter 13 for a discussion of regulatory philosophy specifically for hydrocarbon development in coastal Alabama and Mississippi.

10.11 Oil companies involved with petroleum transportation within the Gulf of Mexico have formed the Marine Industry Research Group (MIRG). The oil spill contingency planning projects have emerged from MIRG (U.S. Department of the Interior, 1983c):

- o Locations of specific clean-up equipment and information about deployment requirements have been organized; and
- o Description of Gulf environments, including countermeasure considerations, have been prepared.

OTHER POTENTIAL MITIGATING PRACTICES

10.12 There are many other mitigating practices and measures that could be utilized to reduce or eliminate environmental effects resulting from oil and gas resource development activities. Mention of a mitigating measure in the following discussion and table does not mean that all or any of the listed items would be necessary, required, or feasible under all situations.

10.13 Establishments which are capable of responding to notifications of an oil spill are important in case major accidents do occur. Eight such establishments are located in the Mobile, Alabama Coast Guard area for rapidly responding with equipment and/or trained teams to remove and contain oil along the coastline. Four of these eight establishments also are capable of containing oil spills in offshore waters. Ten other establishments in Mobile have oil spill clean-up equipment on-hand (U.S. Department of the Interior, 1983c). The two Mobile bases of operation at present have no stockpiled equipment. The Mobile Coast Guard area itself is a rather large area bordered on the west by the New Orleans area and on the east by the Tampa, Florida area. Clean Gulf Associates maintains its equipment at a state of 24-hour readiness, and they also evaluate technological advances for possible inclusion as equipment maintained by the cooperative.

10.14 Equipment considered to be necessary for oil clean-up actions are as follows (U.S. Department of Interior, 1983c):

- <u>For shorefront control</u>: river/harbor boom, skimmer, sorbent, surface collection agent, vacuum/pumper truck, and beach clean-up equipment.

- <u>For offshore control</u>: heavy duty/offshore boom, dispersant, biological agent, and rubber bladder.

Clean-up operations are labor intensive and the personnel need to be well-trained to be effective.

10.15 For any measures to be effective, early response with properly maintained equipment and well-trained personnel is essential. The methods to be utilized must be determined quickly once an accident is reported and described in necessary detail. Such selections are not easy to make, depending upon wave heights, winds, currents, predicted tides, set-up and overall response time and availability of trained personnel. Chemical dispersants and burning are not preferred because of concerns with environmental effects and safety. In fact, dispersants can only be utilized with prior regulatory agency approval. The most commonly utilized methods are booms, skimmers, sorbents, or no action at all depending upon the type of material spilled, size of the spill, type of ecosystems affected by the spill, weather conditions and projected environmental effects of clean-up activities.

10.16 Based on information from Unterberg and Morehead (1981) and the U.S. Department of the Interior (1983c) pipeline-related accidents are more probable than other accident types. Four primary causes of pipeline failures are: (1) anchor dragging and trawling, (2) corrosion, (3) unstable geological conditions, and (4) hydrodynamic forces. Anchors for large industrial vessels and rigs can bury to depths of 5 to 6 meters. Commercial vessel anchors bury themselves 1 to 2 meters. Pipelines cannot feasibly be buried 5 to 6 meters below the sediment-water interface. Therefore, pipelines near rigs are often buoyed to prevent anchor damage (Bureau of Island Management, 1981).

10.17 Specific measures for controlling impacts of accidents can include the following:

- Detailed facilities operations manual including procedures for operation, designation of job responsibilities and personnel training (if not already implemented);

- Emergency shutdown procedures in case accidents occur involving hydrocarbon transfers (e.g., platform to pipeline or pipeline to processing plant transfers);

- Pipeline leak detection methods which avoid interruptions of pipeline use;

- Double-hulled tanks and barges;

- Containment boom around barges during loading and unloading particularly near environmentally-sensitive areas; and

- Avoid use of most toxic drilling fluid additives.

10.18 Inspection procedures during and after facility installation can also help to prevent accidents from occurring. Two types of inspection procedures are:

- Depth of cover inspection for pipelines (using sonar-type equipment for underwater pipeline) perhaps using 1 to 2 years; and

- Periodic inspection by air of pipeline routes for spilled materials.

TABLE 10-1

MITIGATING MEASURES RELEVANT TO OIL AND GAS DEVELOPMENT IN COASTAL ALABAMA AND MISSISSIPPI

CATEGORY	REGULATORY REQUIREMENTS	INDUSTRY PRACTICES	OTHER POTENTIAL MITIGATION MEASURES
WATER QUALITY	Surveys prior to construction activities. 404(b) permitting process for all types of dredge fill activities with possible expansion. Zero discharge rules. Preferred methods to obtain site access. Preferred spoil management techniques. Periodic monitoring of industry practices. Recommend or require particular dredging and pipe-laying techniques. Site restoration requirements. Avoid certain activities at certain times of the year. Supervise canal dredging and other dredging activities. Require "buffer zone" between dredging activity and environmentally sensitive area. Intensify enforcement of permit requirements. Designate certain area(s) as parks or wildlife refuge(s).	Spoil bank development with environmental considerations. Siltation curtains. Coordination with Fish and Wildlife Service field scientists.	Prohibit hydrocarbon-related surface activities at particular locations, based on future research. More extensive use of site monitoring. Innovative surface water runoff control. Utilization of new dredging methods including spoil release and seasonality. Investigate the possibility that dredged material banks with no gaps may be prefered. Minimize wetland disturbance, particularly from October through March. Use of trestle roads to gain site access.
AQUATIC ECOSYSTEMS	Environmental review of permit applications by federal and state agencies and the public. No pollutant discharge requirement. Spill contingency plans.	Use of floating oil spill booms across canals at all times in the Delta. Use of sheet pile around 3 sides of drilling barges in Mobile Bay or Mississippi Sound to reduce area affected, help contain small spills and reduce pad scour. Directional drilling to reduce drilling sites needed.	In the Mobile Delta, reduce or eliminate turbidity by using boring methods for channel crossings, silt curtains when dredging, and directional drilling or other drilling alternatives to reduce dredging requirements. In Mobile Bay, Mississippi Sound and the Gulf of Mexico allow no dredging for well site access; establish buffer zones around seagrass beds and oyster reefs in Alabama waters; plan pipeline routes to avoid areas of particular value such as seagrasses and oyster reefs; replant seagrasses or restablish oyster reefs if disturbed; utilize joint ventures and trunklining to reduce number of pipelines required. Station spill response equipment in the region; store more spill containment equipment at each well location. Acquisition of lands for preservation.

TABLE 10-1 (Continued)

MITIGATING MEASURES RELEVANT TO OIL AND GAS DEVELOPMENT IN COASTAL ALABAMA AND MISSISSIPPI

CATEGORY	REGULATORY REQUIREMENTS	INDUSTRY PRACTICES	OTHER POTENTIAL MITIGATION MEASURES
WETLAND ECOSYSTEMS	Environmental review of permit applications by federal and state agencies. No pollutant discharge requirement. Spill contingency plans. Restoration of canals, slips and pipeline right-of-way.	Directional drilling to reduce drilling sites needed.	In the Mobile Delta, reduce wetland area affected by using alternatives to the canal and slip drilling method, narrow pipeline corridors and joint ventures and trunklining to reduce number of pipelines required. Use directional drilling to reach areas under saltmarshes to the extent practical. In Mobile Bay and Mississippi Sound avoid pipeline landfalls that cross wetlands; use narrow pipeline corridors, reduce the number of pipelines coming onshore by using joint ventures and trunklining.
UPLAND ECOSYSTEMS	Local zoning and land use stipulations. Requirement to consider prime farmland.	Erosion prevention practices. Restoration of drilling, well and treatment facility sites after abandonment.	Joint ventures to reduce acreage required for pipelines and treatment facilities.
THREATENED AND ENDANGERED SPECIES	Requirement to consider effects of activities. Agency coordination with Federal Office of Endangered Species.	Site surveys for presence of endangered species.	Alter project plans to avoid effects on endangered species. Increase spill prevention and control activities.
COMMERCIAL FISHERIES	Use of air gun rather than dynamite for geophysical exploration; required aids to navigation (see navigation category) on new structures.	When possible, establish boat schedules to avoid fishing feet traffic.	No operations in oyster reef areas; avoid grass beds; establish pipeline corridors to minimize fisheries impacts.
GROUNDWATER			
Loss of formation waters or hydrocarbons to aquifers	Alabama casing/cementing requirements: Rules 400-1-3-.03, 400-3-x-.02; prevention of interstrata movement: Rule 400-1-3-.04; Mississippi casing/cementing requirements: Rules 11, 12 and OS-4; prevention of interstrata movement: Rule 10.	Installation of casings and cement.	Use of stronger alloys for casings to inhibit corrosion or rupture; use of inert, resistant liners in casing; use of electric logs to more closely delineate freshwater strata to establish casing requirements.

TABLE 10-1 (Continued)

MITIGATING MEASURES RELEVANT TO OIL AND GAS DEVELOPMENT IN COASTAL ALABAMA AND MISSISSIPPI

CATEGORY	REGULATORY REQUIREMENTS	INDUSTRY PRACTICES	OTHER POTENTIAL MITIGATION MEASURES
Blowouts or casing ruptures	General rules: AL Rule 400-1-3-.04 and 400-3-x-.02, MS Rule 63 and 13.	Installation of multiple blowout preventers; use of warning devices such as kick indicators.	Use of stronger alloys for casings to inhibit corrosion or rupture.
Spills	Federal Clean Water Act; containment of leaks or dikes: MS Rule 61	Collection of leakage or spills by curbing or dikes; zero discharge procedures; monitoring pipelines for corrosion.	Use of corrosion resistant alloys or liners in pipes and transfer equipment.
Infiltration from earthern pits	Regulations for pit usage and construction to prevent groundwater contamination: AL Rule 400-1-5-.03, MS Rule 63.	Use of collection tanks rather than pits for most applications in project area.	Use of spray application of liners to reduce construction time and eliminate seams; Require liners for all pits.
Improper well plugging	Procedures stipulated to ensure protection of groundwater resources: AL Rule 400-1-3-.05, MS Rules 28 and 29. Plugging witnessed by state inspectors.	Regulated well plugging procedures.	
Contamination through fractures	General Federal and state rules for the protection of groundwater; specific requirements for fracturing to protect formations and aquifers: AL Rule 400-1-3-.14.	Geologic surveys to assess fracture/fault zones; computer assisted fracturing operations to predict results and control operations.	Using polymeric compounds to aid in the control of fracturing.
Underground injection	General regulations and standards of Federal UIC Program to protect underground sources of drinking water; specific rules governing injection well construction, injection procedures, designation procedures, designation procedures, designation of allowable injection strata; periodic state inspections of injection well mechanical integrity: AL Rule 400-1-5-.04, MS Rules 45 and 63.	Comply with existing regulations and requirements.	Use better measuring and evaluating techniques to determine formation characteristics; monitoring of aquifers to detect early stages of pollution; use of polymeric compounds to [illegible]ease volume of produced water.

TABLE 10-1 (Continued)

MITIGATING MEASURES RELEVANT TO OIL AND GAS DEVELOPMENT IN COASTAL ALABAMA AND MISSISSIPPI

CATEGORY	REGULATORY REQUIREMENTS	INDUSTRY PRACTICES	OTHER POTENTIAL MITIGATION MEASURES
AIR QUALITY			
Source emissions	40 CRF 61 Appendix A-Testing; new source performance standards, 40 CFR 60; requires best available control technology (BACT); AEROS, NEDS, SOTDAT, EHIS, WSAP, PREMOD (all part of EPA's information retrieval system). January 20, 1984 proposed Federal regulations would limit volatile organic compounds leaks from on-shore gas processing plants; same proposed regulations would put sulfur dioxide emissions limits gas processing facility and require "best demonstrated technology" to be employed	Design equipment sources to minimize emissions; design to least available emission rate	Place precipitators, scrubbers bag-houses, filters or other conventional devices on end of source process to process to remove additional emissions
Ambient air quality standards	Ambient air quality standards, 40 CFR 50; state air quality standards Alabama (Alabama Law-Act 769 H.702), Mississippi, Florida state implementation plans, 40 CFR 51, citizen's suits allowable, 40 CFR 54; state air quality designations, 40 CFR 81	Required to model to predict compliance or degree of same (40 CFR 52.21)	Further reduce by added emission controls as stated above
PSD increments	PSD regulations, 40 CFR 51.24 and 52.21 June 1978; visibility, 40 CFR 51 Part P 51.302; non-compliance penalties, 40 CFR 67	Required to model or monitor to demonstrate compliance (40 CFR 52.21, 40 CFR 51)	Reduce emissions below PSD thresholds; monitor to show impacts below de minimis
Attainment/non-attainment ambient standards	Attainment, 40 CFR Appendix S; delayed compliance orders, 40 CFR 65-66	Required to demonstrate attainment by 2 years of ambient data or 1 year and supportive modeling	Reduce emissions by closing down peripheral sources not part of this operation
Construction and operation practice			
Fugitive dust	Indirect sources, 40 CFR 52.22 (b)	Water sprays; fogging of dust producing sources or roads	Use of surfactants, calcium chloride on roads and storage piles

TABLE 10-1 (Continued)

MITIGATING MEASURES RELEVANT TO OIL AND GAS DEVELOPMENT IN COASTAL ALABAMA AND MISSISSIPPI

CATEGORY	REGULATORY REQUIREMENTS	INDUSTRY PRACTICES	OTHER POTENTIAL MITIGATION MEASURES
Oil and gas vapors	New source performance standards, 40 CFR 60 Part K and Ka Storage of Liquids-Oil and Gas	Limited storage at sea; pipeline to shore	Recovery caps on venting storage tanks
Construction debris	Local "litter" laws; waste disposal limitations; city and county ordinances, permitting required for destruction or removal	Burning debris under permit; enhanced burning techniques through blowers	Bury in landfills; possibly burning at sea under permit
Transportation	FAA and Federal Highway Administrative procedures; vehicular emissions, 40 CFR 86.081, 40 CFR 85.075-9 through 27, 40 CFR 86.1301-84 subpart N	Catalytic converters; filters; operate in daytime if possible	Purified fuel (no-lead); removal of additives; microprocessor controlled fuel flow; more efficient combustion
Peak oil and gas construction activity	Activities usually permitted under Federal and state laws	Limit to needs and economic demands	Delay or space at a more reasonable schedule
Accidental release of pollutants	Mississippi State Oil and Gas Board, Rules of Procedure and Statewide Rules, 1982; Alabama State Oil and Gas Board, 1983; procedural recommendations or various Canadian studies	File emergency plan and procedures; requires protocol listing of who and how notified; evacuation procedures; warnings and alerts; liaison with fire, police, health authorities and methodology for accomplishing same; use warning and detection systems	Provide semi- or completely automatic monitoring and warning system over area in use; use dial-up technology to alert participating safety personnel and agencies; chemically combine H2S with inerting gas
NOISE			
Drilling sites	Noise Control Act of 1972 AL Marine Police Regulations AL Noise Control Laws Individual oil and gas leased tract contractural specifics. USEPA recommendations: L_{dn} = 55 to 65 dBA (residential) $L_{eq}(24)$ = 70 dBA (industrial) Possible city ordinances.	Use of mufflers and enclosures; restriction of some equipment use to daylight hours; possible use of electric cranes.	Improved noise insulating materials.

TABLE 10-1 (Continued)

MITIGATING MEASURES RELEVANT TO OIL AND GAS DEVELOPMENT IN COASTAL ALABAMA AND MISSISSIPPI

CATEGORY	REGULATORY REQUIREMENTS	INDUSTRY PRACTICES	OTHER POTENTIAL MITIGATION MEASURES
Pipeline sites	Noise Control Act of 1972 AL Marine Police Regulations	Use of marine mufflers and enclosures; probably no nighttime construction.	Improved noise insulating materials and below-deck engine noise control.
Service bases/refineries	Noise control Act of 1972 AL Marine Police Regulations AL Noise Control Laws USEPA noise recommendations OSHA regulations Possible city ordinances	Use of mufflers and enclosures; probably no (or reduced) nighttime activity.	Improved noise insulating materials.
Normal operation drilling rigs	Noise Control Act of 1972 AL Marine Police Regulations Individual oil and gas leased tract contractual specifics USEPA noise recommendations OSHA regulations Possible city regulations	Use of mufflers and enclosures (e.g., rig noise abatement); use of electric cranes and heat exchange engines; recycling of pressurized gas from treatment plant for enhanced recovery (as opposed to on-site pumps).	Improved noise insulating materials; possible aesthetic shielding near onshore side of drilling rig or the receptor side(s) of land rig.
Pipelines	Noise Control Act of 1972 AL Noise Control laws AL Marine Police Regulations USEPA noise recommendations Possible city ordinances	Use of mufflers, enclosures and possibly silencers; reduced number of compressor stations (offshore)	Improved noise insulating materials and silencers.
Service bases	Noise Control Act of 1972 AL Marine Police Regulations AL Noise Control Laws USEPA noise recommendations OSHA regulations Possible city ordinances	Use of mufflers and enclosures; probably reduced activity during nighttime.	Improved noise insulating materials.
Gas plants partial processing	Noise Control Act of 1972 AL Noise Control Laws USEPA noise recommendations OSHA regulations Possible city ordinances	Multiport injector systems, mufflers enclosures, baffles, and absorbers.	Improved control technology. Use or greater use of vegetation to buffer noise.

TABLE 10-1 (Continued)

MITIGATING MEASURES RELEVANT TO OIL AND GAS DEVELOPMENT IN COASTAL ALABAMA AND MISSISSIPPI

CATEGORY	REGULATORY REQUIREMENTS	INDUSTRY PRACTICES	OTHER POTENTIAL MITIGATION MEASURES
SOLID WASTE DISPOSAL			
Geophysical exploration	Shot holes and other core holes below freshwater strata must be plugged.	Use of thumper trucks on uplands would reduce the use of shot holes	Use of aquatic exploration wherever possible.
Land clearing for delta operations, processing and service facilities	All potentially hazardous debris and vegetation must be out of well, tank and pump station vicinity. Approved offsite disposal of such waste is available. Open burning of solid wastes is prohibited.	Use of existing waterways in wetlands when possible.	Timber may be sold versus disposal offsite.
Drilling muds, cement, cuttings, sand, and other solid wastes generated by exploration, production, and workover	Zero discharge rules prohibit release of wastes from well sites into water; they must be collected, treated and disposed of in approved onshore facilities. All production facilities must be maintained to prevent pollution. Solid waste facilities must meet design and siting criteria, obtain construction and operations permits, follow monitoring and testing procedures. New drilling wastes are tested prior to disposal permitting.	Wastes containing marketable materials are treated for material reclamation and reuse.	Receptacle specifications could be mandated for waste barges, reducing risks of spills or leaks. Alternative procedures for drilling waste disposal could be used more widely i.e., landfarming, dewatering procedures or incorporating the material into soils as conditioners. A licensing or manifest system for transport of wastes from the drilling site to an approved disposal site could be developed.
Wastes from abandonment	Abandonment procedures specify plugging and severing casing and pilings thus eliminating solid waste at the drill site.	Economics encourages recovery and reuse of materials, vessels and equipment. Unusable materials are sold in place to salvage dealers.	
Waste and by-products from processing and treatment facilities	Federal Resource Conservation and Recovery Act, if applicable, and state solid waste management regulations.	Industry encourages efficient operation of recovery collection and processing facilities.	If some potentially hazardous wastes are generated in sufficient quantity, they might be considered hazardous; if storage, transport and disposal requirements established under RCRA were used when handling these wastes, the quality of the environment and public safety could be better insured.

TABLE 10-1 (Continued)

MITIGATING MEASURES RELEVANT TO OIL AND GAS DEVELOPMENT IN COASTAL ALABAMA AND MISSISSIPPI

CATEGORY	REGULATORY REQUIREMENTS	INDUSTRY PRACTICES	OTHER POTENTIAL MITIGATION MEASURES
SOCIOECONOMIC CONCERNS			
Routine operations			
Effects from OCS	**Federal Regulations and Policy: To prevent or mitigate effects from OCS development, planning grants and credit assistance can be granted under the Coastal Zone Management Act.**		
Transportation of hydrocarbon resources from OCS	**Intergovernmental Planning Program coordinates federal and state transportation (i.e., pipeline) needs and concerns.**		
Recreation/Tourism	**State Policy or Regulations to Reserve Coastal Resources: Protection of public coastal access. Protection of water recreation resources. Protection of natural scenic quality.**	**Offshore platforms enhance recreational fishing.**	
Land Use	**Special Management Areas designated for planning purposes. Energy facility siting procedures to resolve potential coastal land use conflicts. Hearings required when processing plant is proposed.**		
Employment potentially leading to immigration		**Immigration could be reduced by expanding industry practice of hiring locals when possible.**	In the event of immigration from employment opportunities, state revenues from severance taxes and royalties could be allocated specifically to community improvements in potentially affected areas.

TABLE 10-1 (Continued)

MITIGATING MEASURES RELEVANT TO OIL AND GAS DEVELOPMENT IN COASTAL ALABAMA AND MISSISSIPPI

CATEGORY	REGULATORY REQUIREMENTS	INDUSTRY PRACTICES	OTHER POTENTIAL MITIGATION MEASURES
Accident situations	Federal Regulations and Policy Relevant to Accidents on OCS: Operators on OCS required to submit oil spill contingency plans. EPA and U.S. Coast Guard are enforcing agencies for spill containment and clean up and coordination of Regional Response Teams and on scene coordinators for regional cleanups. Pollution compensation - States can be reimbursed for reasonable cleanup costs by federal government.	Operators are members of Clean Gulf Associates. Response and clean up unit is located in Bayou La Batre, Alabama.	
Public Revenues	State Policy or Regulations: Operators must file a bond against the event of accidents to the state oil and gas board prior to drilling activities.		Compensation funds similar to federal plans could be established at state levels to offset potential economic losses to commercial fishing and tourism sectors in the event of an accident. Funds from hydrocarbon taxation could be the principal source of revenues.
Commercial Fishing	Compensation for commercial fisherman depending on circumstances of accident.		
Recreation/Tourism	Emergency Action Plans, including evacuation procedures must be submitted by operators for wells or plants producing resources with hydrogen sulfide gas. This would include tourist populations during peak seasons.		
NAVIGATION	Federally established safety fairways and designated anchorage areas; required aids to navigation (markers, lights, fog signals) for rigs, wellhead, platforms, pipe laying; publicaton in local notice to mariners of new rig or structure locations (includes type of aids to navigation).	Use of chase boat with geophysical surveys; crew changes scheduled for mid-week to avoid heavier weekend traffic.	

TABLE 10-1 (Continued)

MITIGATING MEASURES RELEVANT TO OIL AND GAS DEVELOPMENT IN COASTAL ALABAMA AND MISSISSIPPI

CATEGORY	REGULATORY REQUIREMENTS	INDUSTRY PRACTICES	OTHER POTENTIAL MITIGATION MEASURES
CULTURAL RESOURCES	Cultural resources survey required for major activities prior to start of activities (includes normal survey techniques on land and multi-sensor techniques underwater).		Require cultural resources survey for all portions of land based support activity.
SPILLS AND ACCIDENTS	National and regional accident contingency. Separate spill prevention control and countermeasures (SPCC) plans for above-ground exploration, drilling, production and abandonment. Local SPCC plans for Mobile River Delta, Mobile Bay, Mississippi Sound and Gulf of Mexico. Coordination of accident response team. State emergency response activities. Accident compensation funds. Designation of lead agency for accident response. Regulation of well control. Separate emergency action plans developed by companies. Designate preferred accident response techniques.	Multi-company cooperative for Gulf Coast. Measures to retain well control. Gulf of Mexico Marine Industry Research Group. Spill cleanup contractors. Specified facilities operation and emergency shutdown procedures. Containment booms at end of canal. Response and clean up unit is located in Bayou La Batre, Alabama.	Full-scale accident response center at Mobile and perhaps other locations. Multi-company cooperative(s) for the project area. Burial of pipelines 5 to 6 feet below sediment-water interface in open waters. Containment booms around barges when wastes are being transferred. Frequent pipeline inspection to detect damage and leaks augmented by automatic detection devices.

CHAPTER 11

THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE HUMAN ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

11.1 Few of the effects of the hydrocarbon exploration and production activities postulated in the resource development scenarios would persist beyond the useful life of the projects. As noted in Chapter 1, the expected benefits of the activities would accrue over a period of about 30 years. During this period, many of the ecological disturbances resulting from drilling and production operations and the construction of the pipeline system would be mitigated by natural recovery processes. Impacts such as increased noise levels and those associated with the increased risk of accidents would persist only as long as the period of hydrocarbon production. However, the structures that would be added to the environment as part of the proposed activities could remain beyond the useful life of the project. In addition, some indirect consequences of the proposed project may have tangible effects on the human and natural environment over the long-term. These potential long-term effects include the following:

- <u>Persistence of structures</u>, such as the processing plants, pipelines, and access roads.

- <u>Disturbances along pipeline corridor</u>, such as soil compaction caused by the use of vehicles along the on-land portions of the pipeline systems.

- <u>Modifications of substrate type</u>, such as mixing of sediment layers during pipeline dredging and backfilling operations and the addition of some shell pad material.

- <u>Effects on future land use patterns</u>, such as the development of residential and industrial areas relative to the location of the on-land portions of the pipeline corridors and the processing plants.

- <u>Biological effects due to habitat alteration</u>, such as loss of wetland area until restoration and recovery of canals and slips upon abandonment of a production field.

- <u>Effects on water quality due to waters receiving treated wastewaters</u>, such as disposal of oil processing wastewaters to bodies of water outside the Delta, Bay and Sound.

CHAPTER 12

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

12.1 The production of hydrocarbons at the levels presented in the resource development scenarios would involve the use of a variety of resources that are non-renewable and that may be limited in supply. Most notable, the production of oil, gas and condensate in the levels postulated (Table 12-1) represents a utilization of a finite resource. Based on 198 proven reserves of natural gas in the United States, there are 200 trillion cubic feet of gas recoverable with present technology and prices (U.S. Department of Energy, 1983). Using the resource development scenarios, the volume of natural gas postulated for the high scenario represents about 4.3 percent of the 1982 estimate of total United States reserves. For oil and condensates, the high scenario represents 0.7 percent and 11.7 percent, respectively, of the 1982 estimated total United States reserves.

12.2 The projected development would result in the direct utilization of various other resources which may be limited in supply. These include fuels used to power various types of equipment (e.g., drilling rigs, dredges and supply vessels), financial resources (e.g., investment capital), manpower, and construction materials (e.g., materials used to construct the processing plant and the pipeline). In addition, waste disposal would involve the use of designated on-land waste management facilities which are limited in supply. In particular, the use of deep-well injection for the disposal of liquid wastes would constitute the use of a limited geological resource.

12.3 Biological productivity would be irretrievably reduced or lost during the active life of any particular project. For example, a well successfully completed in the Mobile River Delta using a canal and slip for access would result in the loss of some biological productivity from the altered acreage for the possible 20 to 30 years of hydrocarbon production from the well.

TABLE 12-1

TOTAL RECOVERABLE HYDROCARBON RESOURCE ESTIMATES
FOR THE STUDY REGION

Resource	Resource Scenario High	Moderate	Low
Oil (MM bbl)	200	88	60
Condensate (MM bbl)	830	380	300
Gas (Tcf)	8.6	5.2	3.9

[a] MMbbl = million barrels
[b] Tcf = trillion cubic feet

Source: Appendix B, Table B-2.

CHAPTER 13

INTERAGENCY PERSPECTIVE AND RECOMMENDATIONS

INTRODUCTION

13.1 The objectives of the preceding chapters of this generic environmental impact statement (GEIS) were to:

- Define a given study area and describe the physical, ecological, social, and economic conditions of the area in quantitative and, when data were unavailable, qualitative terms.

- Estimate the potential hydrocarbon resources of the study area to the extent possible based on existing data.

- Identify and evaluate the reasonable unit actions available to industry to explore for and produce hydrocarbon resources.

- Develop reasonable scenarios of the most likely range of hydrocarbon activities that might occur during the next 30 years.

- Evaluate and display the environmental impacts to the given study area based on the scenarios.

13.2 During the scoping process of this GEIS it became evident that some general assumptions were needed to manage the alternatives that could be subject to evaluation. These assumptions were established at the beginning of the GEIS process and continued throughout. The adoption of these assumptions does not preclude future evaluation of activities that would violate the assumptions; rather, it means that the singular and accumulative impacts and subsequent conclusions and recommendations could be invalid and a separate environmental evaluation, based on the revised assumption, would be required prior to decision on a permit application containing an exception to the assumptions in this GEIS.

13.3 The major environmental impact limiting assumptions for this GEIS are:

- No discharge of cuttings, drilling fluids, formation waters, contaminated wastewaters or contaminated rainwater runoff into area waters.

- o All pipeline trenches will be backfilled.

- o All canals and slips for use of an inland drilling barge will be restored to pre-project contours upon abandonment.

- o All access channels will be backfilled upon abandonment.

- o All regulations will be followed.

- o Scenarios are based on minimizing the number of surface structures (multiple drilling from platforms to maximum extent), and some joint ventures will be used for pipelines.

13.4 An important purpose of this GEIS is to expedite the permitting process for hydrocarbon activities within the given study area while protecting natural and man-made resources. As a guide for the permitting process, an interagency perspective and subsequent recommendations, drawn from the preceding chapters, are presented in this chapter.

PERSPECTIVE

Potentially Significant Impacts

13.5 Based upon the analysis of the impacts associated with the various activities involved in the exploration, development and production of hydrocarbons in the study area, the following potentially significant adverse impacts for the entire study area have been identified. Any activity associated with hydrocarbon operations that results in an impact upon the following environmental or socioeconomic factors is considered potentially significant.

a. Loss of natural resources.

1. Wetlands.

2. Submerged aquatic grassbeds or macroscopic algal communities.

3. Normally living oyster reefs and other live bottoms.

4. Exposed hard bottoms.

5. Bird rookeries and populations.

b. Restriction of fishing activities.

1. Trawling and seining.

c. Degradation of air quality.

1. Exceed allowable air quality degradation increment near urban/industrial areas.

2. Exceed short-term ambient air quality standards near gas processing facilities.

3. Hydrogen sulfide or other toxic gas release for more than a short time.

d. Degradation of groundwater quality.

1. Pollution of aquifers due to leaching of pollutants from unlined ponds or lagoons.

2. Accidental contamination of potable aquifers via the well bore including disposal wells.

e. Degradation of viewshed.

1. Location of platforms and rigs which can be readily seen from high use beaches.

f. Accidents.

1. The loss of well control or pipeline failure that would result in the release of oil, H_2S or other type gas to the environment is identified as being of great concern due to the potential adverse impacts that such an accident would have upon living resources, water quality, human life, health, and property.

Minor Impacts and Concerns

13.6 Although the following items were not demonstrated in the GEIS to qualify as potentially significant impacts, they are items of concern or items that could result in minor impacts and should be considered as permit applications are being evaluated and the hydrocarbon industry is developing in the study area. Included in this minor impacts category are:

1. Increased turbidity from various oil and gas activities.

2. Air emissions from flares, crew boats, generators (burning refuse in delta, marsh situation).

3. Inadvertent impacts to cultural resources and endangered species habitat.

4. Alterations in surface drainage patterns and circulation which could result in modifications in sediment transport.

5. Competition between hydrocarbon interests, and commercial and recreational waterway and facility users.

6. Increased demand on berthing and service facilities for support vessels.

7. Local impacts associated with construction of new support facilities.

8. Local impacts to secondary road system due to increased vehicular traffic for land-based or land-accessed rigs and construction activities (concrete trucks, 18-wheelers, sand blasting carriers, etc.).

9. Local impacts due to increased demand on public facilities such as sewage treatment plants, potable water systems, fire protection, waste disposal operations, etc.

10. Changes in salinity regimes in the Mobile Delta due to trenching, channelization and circulation restrictions such as dikes, levees, and roadways.

11. River and canal bank erosion due to damaging wakes from crew boats servicing rigs.

12. Public perception of potential public health hazards due to transportation and disposal of drilling wastes in upland sites.

13. Disturbances to bottom communities during transportation and emplacement/displacement of submersible rigs.

14. Disturbances to sensitive wetlands during pipeline construction, roadway construction, and other activities under the provisions of the Nationwide permit or outside the jurisdictior authority of the regulatory agencies, yet close enough to sensitive jurisdictional area to create synergistic impacts.

RECOMMENDATIONS

Permits

13.6a The Generic EIS serves as support information for the Mobile District Corps of Engineers regulatory program. There are two categories of permitting under this program including general and individual permits. As specified in the rules of the Corps of Engineers regulatory program published in the Federal Register July 22 1982, there are two types of general permits referred to as nationwide and regional permits.

13.6b A nationwide permit is a form of general permit which authorizes a catagory of activities throughout the nation. Nationwide permits are designed to allow work to occur with little, if any, delay or paperwork. However, the natiowide permits are valid only if the conditions applicable to the nationwide permit are met. There currently exists nationwide permits for discharge of dredged or fill materials in certain waters of the United States and certain specific activities. The permit listings are too lengthy to present herein but are contained in the July 22 1982 rules.

13.6c A regional permit is a form of a general permit also designed to reduce paperwork and processing time. Based upon appropriate environmental evaluations, regional permits may be issued by the District Engineer for specified activities and areas.

13.6d If a proposed activity is not covered by a nationwide or regional general permit, it is not precluded but rather must be processed under an individual permit application This type of permit action addresses site-specific activities proposed by a particular permit applicant.

13.6e Based upon analysis contained in the Generic EIS, the cooperating agencies have developed recommendations for the permitting program related to hydrocarbon exploration and development in the study area. These recommendations are detailed in the following paragraphs.

13.7 Mobile Delta. Due to the ecological sensitivity of the Mobile Delta and the lack of specific data to support a finding of no significant impacts, it is recommended that no general permit be considered for hydrocarbon activities in the Mobile Delta at this time, other than the nationwide general permit currently in effect. All other activities would continue to be processed under individual permit applications. Further studies are recommended for the Delta.

13.8 Mobile Bay, Mississippi Sound and Gulf Coastal Waters. An evaluation of data contained in this GEIS coupled with experience gained from drilling operations in the Mobile Bay and adjacent waters support the recommendation for a general permit to include specific activities in selected portions of the study area. Recommended elements of this general permit are as follows:

PROPOSED GENERAL PERMIT
FOR HYDROCARBON EXPLORATORY/APPRAISAL DRILLING ACTIVITIES
IN MOBILE BAY/MISSISSIPPI SOUND AND
ALABAMA/MISSISSIPPI OFFSHORE WATERS

Hydrocarbon exploratory and appraisal drilling activities may be conducted on the above referenced areas provided the following conditions are met.

Condition Number 1: All applicable State and Federal Regulatory requirements are met.

Condition Number 2: No discharge of drilling muds, cuttings, fluids, production (formation) waters, contaminated deck drainage, or sanitary wastes.

Condition Number 3: No dredging associated with the activity except that necessary for drilling pad site preparation. The limits of dredging shall not exceed 3,500 cubic yards from an area of 75 feet by 250 feet and the dredged material shall be transported to an approved designated disposal site. Only clean oyster shell, clam shell, or coarse aggregrate may be used for the drilling pad.

Condition Number 4:

A. In Alabama, the drilling site must be beyond one mile from shorelines fronting the Gulf of Mexico and one-half mile from other shorelines.

B. In Mississippi, the drilling site must be beyond one mile from any shoreline.

C. In Alabama and Mississippi, the drilling site must be beyond one mile from producing oyster reefs as defined or specified by the affected State and one-fourth mile from any known community of submerged aquatic vegetation. For verifications see Condition Number 8.

Condition Number 5: Submittal of a project-specific State approved oil spill contingency plan and blowout prevention plan.

Condition Number 6: Provide adequate navigation markings required by the affected State and United States Coast Guard.

Condition Number 7: No drilling rig will be located within established safety fairways and a 500-foot buffer zone will be provided on either side of other Federally maintained navigation channels and a 500-foot buffer zone provide on either side of pipelines. (Note: All structures and anchors must be placed in compliance with 33 CFR 209.135, July 1, 1983).

Condition Number 8: Survey Requirements. Before an action can be considered as qualifying under the provisions of this General Permit, the applicant must complete environmental and cultural resources surveys and submit the surveys with the application for authorization under this General Permit to the District Engineer.

Environmental Survey Requirements Applicable to Mississippi Resources

As a necessary corollary to Condition Number 4, an environmental survey shall be conducted in Mississippi to determine if, at the community level, submerged seagrass beds and attached macro- scopic algae are within 1,300 feet of the perimeter of the area to be disturbed. This survey shall be required only in the following areas.

1. Passes between the barrier islands with the survey area extending 2 miles north of a line representing the shortest distance between adjacent islands.

(See the attached map which shows the southern boundary limit for required environmental survey work in passes east of the Gulfport Ship Channel.)

2. A zone within 2 miles of the shoreline of Cat Island (a barrier island).

3. A zone within 2 miles of only the northern shoreline of the other barrier islands (Ship, Horn and Petit Bois).

4. A zone within 1.5 miles of the shoreline of Round Island.

5. A zone extending 2 miles south from the opening to the Point Aux Chenes Bay.

In Mississippi, also an environmental survey shall be conducted to determine if hard bottoms or oyster reefs are within 300 feet of the perimeter of any area to be disturbed. However, neither the 300 ft. nor the 1,300 ft. environmental survey will be required in the state's territorial waters of the open Gulf which are located east of the Gulfport Ship Channel. These particular waters are located south of the barrier islands.

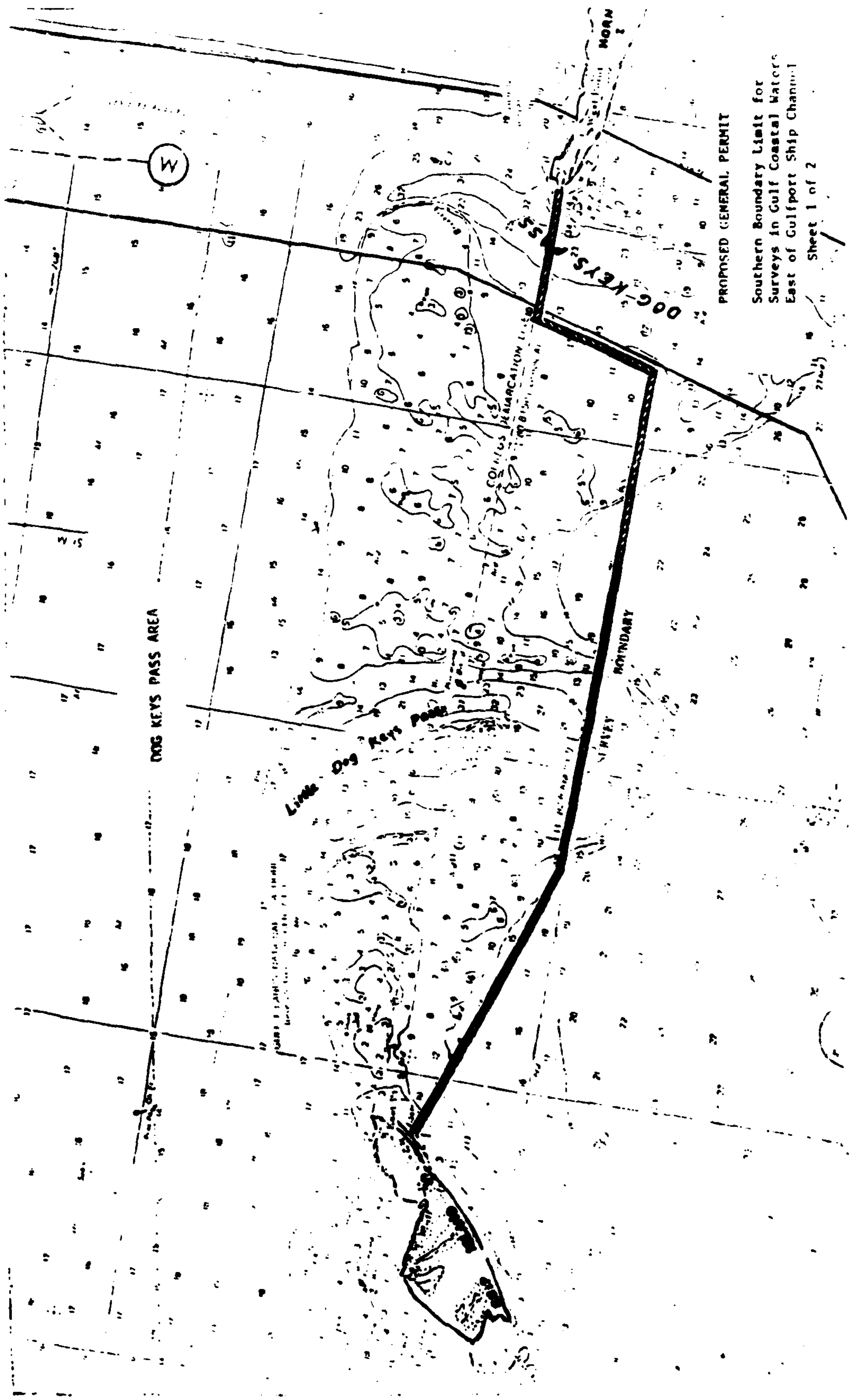
Environmental Survey Requirements Applicable to Alabama Resources

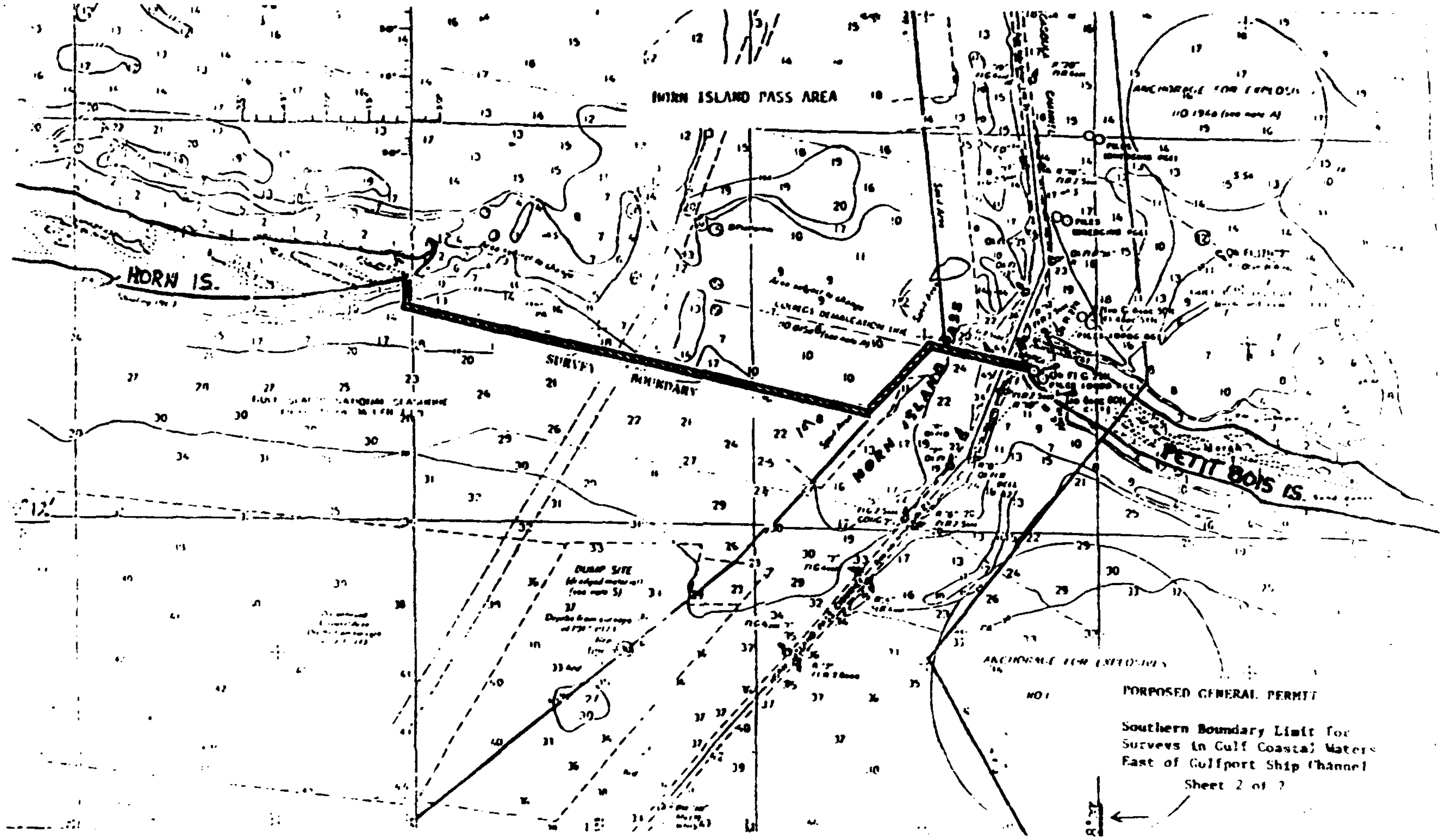
This environmental survey shall include the identification and location of oyster reefs, hard bottoms, submerged seagrass beds and attached macroscopic algal communities within a 300-foot radius of the area to be disturbed. No environmental survey would be required in the State's Gulf coastal waters.

Cultural Resources Survey Applicable to Alabama and Mississippi

For cultural resources consideration, the survey shall be in accordance with the Mobile District, Corps of Engineers requirements.

Condition Number 9: The application for authorization under this General Permit, along with the required environmental or cultural resource surveys, will be subject to a ten-day agency review. The U.S. Army Corps of Engineers will consider agency comments in the permit decision.


PROPOSED GENERAL PERMIT
Southern Boundary Limit for
Surveys in Gulf Coastal Waters
East of Gulfport Ship Channel
Sheet 1 of 2
DOG KEYS PASS AREA
DOG KEYS PASS
Little Dog Keys Pass
SURVEY BOUNDARY
HORN I


HORN ISLAND PASS AREA
HORN IS.
HORN ISLAND
PETIT BOIS IS.
SURVEY BOUNDARY
DUMP SITE
PORPOSED GENERAL PERMIT
Southern Boundary Limit for
Surveys in Gulf Coastal Waters
East of Gulfport Ship Channel
Sheet 2 of 2

13.8a Although sufficient information is unavailable for further recommendations for a regional general permit, the GEIS provides an environmental analysis foundation to support further evaluation of specific permit actions under individual permit applications for the study area. This backup information provided by the GEIS should contribute to an efficient processing of individual permit applications for activities and areas not covered by existing nationwide or recommended regional general permits.

Environmentally Preferred Alternatives

13.9 The GEIS discusses mitigation to lessen impacts from various alternative unit actions and scenarios. While recognizing that these alternatives exist, this section supplements those discussions by identifying least-damaging options recommended to industry.

3.10 The following environmentally preferred alternatives have been developed to encompass consideration of potentially significant impacts and activities preferred to be avoided. These alternatives would minimize to the extent practicable adverse environmental impacts. Although these conceptual alternatives may not be feasible in all cases for the geographic zones of reference, they serve as a focal point and basis of encouragement to industry in developing the most environmentally acceptable plans. These environmentally preferred alternatives for each geographic area are presented here.

13.11 Delta. Environmentally preferred techniques to minimize wetland and riverine disturbances are suggested as, but not limited, to:

1. a. Directional (slant) drilling not requiring any dredging in wetlands or minimized safety risks by location of drilling rig at a river bank slip.

   b. Drill site access by air with minimal clearing of trees in immediate area of drill site.

   c. Trestle road and portable land rig with operations base upland; or with an operations base on barges moored at a river location not requiring any wetland dredging.

   d. Use of board road on natural grade without fill material placed in wetland.

   e. Employ horizontal boring for pipeline installations through wetlands and through riverine environment.

f. Sufficient alert and leak detection equipment on pipelines for drilling fluids, muds, liquid wastes and hydrocarbon products for duration of activities.

g. Crew boat trips minimized and under reduced speed and wake operation to minimize bank erosion.

2. Rigs not located near bird rookeries to minimize noise disturbance.

3. Applicant participation in a rapid deployment spills response team on continuous call from a local operations base stockpiled with state-of-the-art spill containment equipment and clean-up materials to handle a major accident.

4. Restricted public access within one half mile of facilities to minimize danger from H_2S accidents.

5. A waste management plan designed for secure handling of sludges, wastewaters and solid wastes during maximum flooding conditions. Plan should include tank containment of sludges and wastewaters on the rig platform and frequent conveyance to upland or to a waste barge moored at a river site via temporary above-grade pipeline.

6. Testing of waste residuals (sludges) generated from drilling mud reprocessors/disposers for RCRA category.

13.12 Bay/Sound and Alabama/Mississippi Offshore Waters. The Recommended General Permit Criteria identified in this EIS constitute the preferred alternatives. In addition, the following elements would be included.

1. Employment of shallow draft rig and barge equipment to avoid dredging.

2. Use of directional drilling, trestle road or air transport to access drill sites in marsh.

3. Avoid pipeline landfalls where marsh or aquatic grassbeds are present.

4. Horizontal boring to install pipelines under sensitive areas.

5. Sufficient alert and leak detection equipment on all pipelines and rigs and production facilities.

6. Minimize bay bottom trenching by joint venture pipelines and installing multiple pipelines in single corridor.

7. Participation in a local rapid deployment spills response team on continuous call and fully operational.

8. Prompt refilling of pipeline trenches through water bottom.

9. Avoid gas treatment plant or rig sitings near urban/ industrial or Class I air quality areas.

10. Testing of waste residuals (sludges) generated from drilling mud reprocessors/disposers for RCRA category.

Surveillance and Progressive Assessment

13.13 Increased hydrocarbon activities as a result of general and nationwide permitting in sensitive wetland and aquatic ecosystems of coastal Alabama and Mississippi pose the potential for some of the significant adverse effects which have been identified in the GEIS. Also, other underlying potential impacts remain which have not been delineated as significant but are of general concern.

13.14 Federal, State, and local authorities directly involved in regulating the hydrocarbon industry should consider the anticipated scope of hydrocarbon activities and the identified cumulative impacts which may result. This consideration could be accomplished by progressive assessments and consistent surveillance. Benefits derived would include:

a. An ongoing identification of actual impacts.

b. Improved permit compliance monitoring.

c. Opportunity to evaluate the construction and operations of ongoing hydrocarbon activities.

d. Provide background to encourage industry to seek innovative technology.

CHAPTER 14

LIST OF PREPARERS

14.1 The Generic Environmental Impact Statement has been prepared by the following cooperating agencies:

- Lead Agency
  U.S. Army Corps of Engineers, Mobile District

- Cooperating Agencies
  U.S. Environmental Protection Agency, Region IV
  U.S. Fish and Wildlife Service
  National Marine Fisheries Service
  Alabama Department of Environmental Management
  Alabama Oil and Gas Board
  Mississippi Department of Natural Resources
  Mississippi Department of Wildlife Conservation, Bureau of Marine Resources
  Mississippi Oil and Gas Board

14.2 Mr. K. Paul Bradley was the project manager for the Corps of Engineers. Assistance to the Corps of Engineers was provided by The MITRE Corporation, McLean, Virginia. Mr. F. Theodore Bisterfeld was the project manager for the U.S. Environmental Protection Agency, Region IV. Assistance to the Environmental Protection Agency was provided by Applied Biology, Inc., Decatur, Georgia and Gannett Fleming Corddry and Carpenter, Inc. of Harrisburg, Pennsylvania.

14.3 The U.S. Environmental Protection Agency was responsible for analyses of water quality, air quality, noise, solid and hazardous wastes, and the physical aspects of spills and loss of well control. The Corps of Engineers was responsible for all other analyses. A list of preparers is given in Table 14-1.

TABLE 14-1

LIST OF PREPARERS

Preparer, Degree and Affiliation	Experience	Report Contribution
Wade H.B. Smith Ph.D., Ecology. The MITRE Corporation	8 years experience as Project Staff and Project Leader for The MITRE Corporation on environmental studies and impact statements related to energy development, dredged material disposal, hazardous waste disposal, recreational developments in aquatic environments and wastewater disposal. 4 years experience in field studies of the effects of cooling water discharges on marine ecosystems.	MITRE Project Manager; Chapters 1, 2, Chapter 3 - Aquatic Ecosystems - Wetland Ecosystems - Upland Ecosystems - Threatened and Endangered Species Chapters 4, 5, 6, 7 - Wetland Ecosystems - Aquatic Ecosystems - Upland Ecosystems Chapter 8 - Approach to Analysis - Wetland Ecosystems - Aquatic Ecosystems - Upland Ecosystems Chapter 10 - Wetland Ecosystems - Aquatic Ecosystems - Upland Ecosystems
Leo J. Boberschmidt B.S., Geology/Anthropology. The MITRE Corporation	11 years experience as Environmental Systems Scientist for The MITRE Corporation, involved in the environmental analysis of construction and energy development projects and hazardous and radioactive waste disposal programs. In support of NEPA activities, has developed impact assessment methodologies and performed environmental impact analysis of a wide variety of site-specific, regional, national, programmatic, and legislative activities. 8 years experience as researcher/cartographer responsible for research and preparation of maps, scientific graphics, and historical reconstructions.	Chapter 3 - Climate - Geology - Soils - Prime Farm Land - Commercial Fisheries - Cultural Resources Chapters 4, 5, 6, 7 - Wetland, Aquatic, and Upland Areas Disturbed - Navigation - Cultural Resources - Commercial Fisheries Chapter 8 - Commercial Fisheries - Cultural Resources

TABLE 14-1 (Continued)

LIST OF PREPARERS

Preparer, Degree and Affiliation	Experience	Report Contribution
Leo J. Boberschmidt (continued)		- Navigation - Pipeline Rupture Chapter 10 - Commercial Fisheries - Cultural Resources - Navigation Chapters 9, 11, 12.
Tina S. McDowell B.A., Anthropology. The MITRE Corporation	5 years experience as a Research Associate and as a member of the Technical Staff of the MITRE Corporation analyzing social, economic, and cultural effects from domestic energy-related projects and for various Federal initiatives affecting foreign countries.	Chapter 3 - Subregional Socioeconomic Characteristics Chapters 4,5,6,7 - Subregional Socioeconomic Concerns Chapter 8 - Subregional Socioeconomic Effects Chapter 10 - Subregional Socioeconomic Mitigation Chapter 14 Chapter 15 Appendix F
George A. Malone B.S., Chemistry, Chemical Engineering. The MITRE Corporation	11 years experience as a project engineer and project manager in energy technology and resource development. Experience includes synthetic fuels technology development; coal and petroleum resource assessment; industrial and utility power generation design; combustion environmental control systems design; environmental impact analysis for oil, gas and coal resources utilization; technology development for unconventional gas resource development.	Appendix A - Description of Unit Action Appendix C - Drilling and Production Scenarios - Model Development and Implementation Scenario

TABLE 14-1 (Continued)

LIST OF PREPARERS

Preparer, Degree and Affiliation	Experience	Report Contribution
Ronald N. Hoffer M.S., Geology. The MITRE Corporation	10 years experience in the applications of geology and water resources to energy development and environmental problems. Certified Professional Geological Scientist (No. 6221), AIPG.	Appendix B - Prepared Appendix B from proprietary report submitted by Myerhoff and Creath.
Wilgus B. Creath A.B., Geology. Associated Resource Consultants, Inc.	30 years of professional experience in geological research investigating oil and gas resources, assessing impacts of hazardous waste disposal and geothermal projects on groundwater, groundwater studies and other mineral and resource evaluations on a world-wide basis.	Appendix B - Worked on proprietary resource estimate used as the basis for Appendix B.
Arthur A. Meyerhoff Ph.D., Geology. Associated Resources Consultants, Inc.	35 years experience in hydrocarbon resource estimation, geologic mapping and geophysical studies in the United States, Canada, Central and South America, Europe, Asia, Africa and Australia. 137 scientific publications, 70 on petroleum, geology and resources.	Appendix B - Made proprietary resource estimates used as the basis for Appendix B.
Nancy W. Wells Ph.D., Microbiology. Applied Biology, Inc.	35 years experience in project management water chemistry, population ecology, microbial physiology, threatened and endangered species management and research design.	Applied Biology, Inc., Project Director
Frank A. Gheesling, Jr. B.S.F.R., Forest Resource Management. Applied Biology, Inc.	15 years of experience in project management vegetation mapping, photogrammetry, environmental impact analysis and natural resource management.	Applied Biology, Inc., Project Manager
Francis E. Courtney, Jr., M.S., Meteorology. Subcontractor to Applied Biology, Inc.	40 years of experience in air quality monitoring, air quality modeling, impact assessment, expert witness and climatology.	Chapter 3 - Air Quality Chapters 4,5,6,7 - Air Quality Chapter 10 - Air Quality Mitigation

TABLE 14-1 (Continued)

LIST OF PREPARERS

Preparer, Degree and Affiliation	Experience	Report Contribution
Gilbert S. Nicolson Ph.D., Water Resource Management. Applied Biology, Inc.	22 years experience in mathematical modeling, water resource planning, stormwater planning, hydraulic data acquisition and analysis, environmental impact analysis and design of mitigative measures, and management information system planning and design.	Chapter 3 - Groundwater Chapters 4,5,6,7 - Groundwater Chapter 10 - Groundwater Mitigation
Kenneth J. Stockwell M.En., Environmental Engineering. Applied Biology, Inc.	11 years experience in water and wastewater treatment system design, wastewater chemical and biological components effects, hydrologic and geohydrologic analysis, environmental management, sludge and solid waste management.	Chapter 3 - Groundwater Chapters 4,5,6,7 - Groundwater Chapter 10 - Groundwater Mitigation
Clyde M. Kennedy, III M.S., Civil Engineering. Subcontractor to Applied Biology, Inc.	34 years experience in soil and foundation engineering, engineering geology, subsurface exploration and instrumentation, inspection of foundation and earthworks construction.	Chapter 3 - Solid Waste Chapters 4,5,6,7 - Solid Waste Chapter 10 - Solid Waste Mitigation
Jerald D. Hitzemann M.C.P., Land Use and Environmental Planning. Applied Biology, Inc.	16 years experience in site, community and regional planning, economic studies, noise pollution research, community/government coordination, project management and EIS preparation.	Chapter 3 - Solid Waste and Noise Chapters 4,5,6,7 - Solid Waste and Noise Chapter 10 - Solid Waste and Noise Mitigation
Christian M. Hoberg M.S., Marine Science. Applied Biology, Inc.	17 years experience in environmental assessment and monitoring, laboratory bioassay, technical writing, quality assurance.	Chapter 3 - Noise Chapters 4,5,6,7 - Noise Chapter 10 - Noise Mitigation

TABLE 14-1 (Concluded)

LIST OF PREPARERS

Preparer, Degree and Affiliation	Experience	Report Contribution
David B. Babcock, P.E. M.S., Environmental Engineering. Subcontractor to Applied Biology, Inc.	11 years experience in wastewater engineering/planning, water resources engineering/planning, water quality assessments and EIS preparation.	Chapter 3 - Surface Water Quality and Hydrology Chapters 4,5,6,7 - Surface Water Quality and Hydrology Chapter 10 - Surface Water Quality and Hydrology Mitigation
H. Jeffrey Elseroad M.S.E., Environmental Engineering. Subcontractor to Applied Biology, Inc.	17 years experience in environmental science, water quality assessment, and environmental impact analyses.	Chapter 3 - Surface Water Quality and Hydrology Chapters 4,5,6,7 - Surface Water Quality and Hydrology Chapter 10 - Surface Water Quality and Hydrology Mitigation
Stephen G. Desesa B.S., Environmental Engineering. Subcontractor to Applied Biology, Inc.	9 years experience in environmental assessment, wastewater treatment facility evaluations and water quality analysis.	Chapter 3 - Surface Water Quality and Hydrology Chapters 4,5,6,7 - Surface Water Quality and Hydrology Chapter 10 - Surface Water Quality and Hydrology Mitigation
Richard C. Winter Ph.D. Candidate, Urban and Regional Planning. B.A., Economics. Energy and Environmental Systems Division, Argonne National Laboratory	4 years experience as environmental scientist providing technical support, evaluating socioeconomic effects from a variety of energy related projects, and developing impact models for impact assessments. 11 years experience as planning director in rural Wyoming.	Chapter 8 - Summary on the Economic Impact Assessment model (EIAM) Appendix F - Description of the Economic Impact Assessment Model

CHAPTER 15

PUBLIC INVOLVEMENT

15.1 Agencies, interested groups, and the public have been continuously involved in the U.S. Army Corps of Engineers (COE) evaluations and permit review process for hydrocarbon resource activities in Mobile Bay, Mississippi Sound, the Alabama State Waters of the Gulf of Mexico and the Mobile Delta. Three environmental impact statements (EIS) and one environmental assessment have been prepared for exploration, appraisal, and development of the resources from offshore leased tracts in accordance with applicable guidelines. The environmental documents were coordinated for review by the COE and filed with the U.S. Environmental Protection Agency.

15.2 Because of the size of hydrocarbon finds resulting from the earlier sales, and the monetary amounts of the successful bids, state and federal agencies are attempting to speed up their permitting processes.

15.3 In response to these needs, the U.S. Army Corps of Engineers, Mobile District, with the assistance of cooperating federal and state agencies comprising the Executive Review Board (Table 15-1), has prepared this generic environmental impact statement. As a first step in the scoping process for the EIS, a strategy meeting was conducted on September 21, 1982 by the Executive Review Board to identify adminstrative needs, roles of cooperating agencies, a schedule for the EIS process, and a scope of work to present for public comment. A Technical Committee of the Board was formed which has met intermittently throughout the EIS process. After the initial strategy meeting, the Executive Review Board has formally met five additional times:

- September 30, 1982
- November 29, 1982
- February 1, 1983
- April 18, 1983
- August 30, 1983

15.4 To involve the public in the scoping process, a notice of intent to prepare the draft generic environmental impact statement was submitted to the Office of the Federal Register on October 15, 1982. To include all parties interested in hydrocarbon resource development offshore Alabama and Mississippi, two public hearing notices and meetings were conducted. On November 1982, a notice of the Alabama hearing was issued. The meeting took place in Mobile on the 9th of December 1982. Similarly, a public hearing

TABLE 15-1

COOPERATING AGENCIES OF THE EXECUTIVE REVIEW BOARD

U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
National Marine Fisheries Service
Alabama Department of Environmental Management
Alabama Oil and Gas Board
Mississippi Department of Natural Resources
Mississippi Department of Wildlife Conservation, Bureau of Marine Resources
Mississippi Oil and Gas Board

announcement for the Biloxi, Mississippi meeting was issued on the 12th of November. The meeting occurred on December 14.

15.5 The public hearings were held by the Corps of Engineers in cooperation with the following state and federal agencies:

- o Alabama Department of Environmental Management
- o Alabama Oil and Gas Board
- o Mississippi Department of Natural Resources
- o Mississippi, Department of Wildlife Conservation, Bureau of Marine Resources
- o Mississippi Oil and Gas Board
- o The National Marine Fisheries Service
- o The U.S. Environmental Protection Agency, and
- o The U.S. Fish and Wildlife Service

15.6 The comment period on the scope of work following the public meetings closed January 15, 1983. Limited public comments were received and there was a general lack of objection.

15.7 In addition to the formal public involvement, individuals from state and local agencies and the petroleum industry have participated in the EIS process. A meeting with petroleum company representatives, hosted by the Corps of Engineers was held on February 22, 1983 to describe the organization of the GEIS and the resource estimates. A list of the attendees to the February meeting is given in Table 15-2.

15.8 The draft generic environmental impact statement was mailed to the following parties:

- o U.S. Environmental Protection Agency
- o U.S. Department of the Interior
- o U.S. Department of Commerce
- o U.S. Department of Energy
- o U.S. Department of Housing and Urban Development
- o U.S. Department of Transportation
- o U.S. Department of Agriculture
- o U.S. Department of Health and Human Services
- o U.S. Food and Drug Administration
- o Alabama Oil and Gas Board
- o Alabama Department of Environmental Management
- o Alabama Attorney General
- o South Alabama Regional Planning Commission
- o Mississippi Oil and Gas Board
- o Mississippi Department of Natural Resources
- o Mississippi, Department of Wildlife Conservation, Bureau of Marine Resources
- o Mississippi Attorney General
- o Mississippi Gulf Regional Planning Commission

TABLE 15-2

REGISTER OF ATTENDEES

BRIEFING AT NEW ORLEANS TO OIL
COMPANIES ON FEBRUARY 22, 1983

Mr. Randall A. Jones Associate Environmental Specialist Shell Offshore, Inc. New Orleans, LA	Mr. H. W. Nasse Coordinator, Environmental and Regulatory Affairs Chevron, USA Inc. New Orleans, LA
Mr. John R. Gradishar Senior Drilling Engineer Shell Offshore, Inc. New Orleans, LA	Mr. James Raley Offshore Leasing - Expl. Amoco Production Co. New Orleans, LA
Dr. William E. Workman Consultant to Superior, Mobil, Celeron, Florida Exp. Co. Fairhope, AL	Mr. James R. O'Leary Public Affairs Representative Amoco Production Co. New Orleans, LA
Mr. J. S. Buchanan Special Projects Superior Oil Lafayette, LA	Mr. Hugh C. Forshner, Attorney Amoco Production Co. New Orleans, LA
Mr. W. A. Settoon, Jr. Planning Manager Superior Oil Lafayette, LA	Mr. Bob Fritz, Attorney MOEPSI New Orleans, LA
Mr. Robert B. Bellamy Area Petroleum Engineer Union Oil Co. of California Houma, LA	Mr. Woody Musson Venture Manager MOEPSI New Orleans, LA
Dr. Harland E. Johnson Environmental Conservation Manager Exxon New Orleans, LA	Mr. Glen Pilie Regulatory/Environmental Coordinator MOEPSI New Orleans, LA

TABLE 15-2 (Continued)

REGISTER OF ATTENDEES

Ms. Joni Martin Regulatory-Compliance Corrdinator Texaco Inc., Offshore Division New Orleans, LA	Mr. Don LeBlanc Sr. Production Analyst Tenneco Lefayette, LA
Mr. Kenny Holtgreve Regulatory and Envir. Supervisor ARCO Oil and Gas Co. Lafayette, LA	Mr. Roy E. Hogan Prin. Offshore Engineer Phillips Petroleum Co. Houston, TX
Mr. Oscar E. Pena Civil Engineer/Manager Texaco USA - Prod. New Orleans, LA	Mr. David J. LeBlanc Environmental Coordinator Texaco USA - Prod. New Orleans, LA
Mr. Richard Estess District Landman Placid Oil Company New Orleans, LA	Mr. Delmer Jones Drilling Manager Celeron Oil & Gas Co. Lafayette, LA
Mr. Clyde Adcock, Jr. Drilling Engineer Celeron Oil & Gas Co. Lafayette, LA	Mr. Ed Luper Subsurface Geologist Mississippi Bureau of Geology Jackson, MS
Mr. Richard C. Winter Program Manager/Socioecon. Argonne National Laboratory Argonne, IL	Mr. Alan V. Galdis Social Scientist Corps of Engineers Mobile, AL
Mr. James Hildreth Study Director Corps of Engineers Mobile, AL	Mr. Ted Bisterfeld Project Officer (EIS) U.S. EPA, Region IV Atlanta, GA
Mr. Bob McGuire Environmental Engineer Corps of Engineers Mobile, AL	Mr. Wilgus B. Creath Associated Resource Consult. Tulsa, OK

TABLE 15-2 (Concluded)

REGISTER OF ATTENDEES

Dr. Art Meyerhoff Associated Resource Consultants Tulsa, OK	Mr. Charles (Cork) Grandy Vice President The MITRE Corporation McLean, VA
Dr. Lydia W. Thomas Technical Director The MITRE Corporation McLean, VA	Mr. Ron Hoffer Technical Staff The MITRE Corporation McLean, VA
Mr. George Malone Technical Staff The MITRE Corporation McLean, VA	Dr. Wade Smith Group Leader The MITRE Corporation McLean, VA

15.9 A public hearing on the draft generic environmental impact statement was held in Mobile, Alabama on 14 June 1984. Issues raised in comments received during the hearing were similar to those expressed in written letters of comment received by the Mobile District. Responses to comments are given below.

15.10 Twenty-nine letters of comment on the draft generic environmental impact statement were received by the end of the comment period on 28 June 1984. These letters are reproduced on the following pages along with responses to the comments indicated in the margin of each letter.

LETTERS OF COMMENT AND RESPONSES

TABLE OF CONTENTS

LETTER 1

THAD COCHRAN

United States Senate

WASHINGTON, D.C.

COMMITTEE ON AGRICULTURE, NUTRITION, AND FORESTRY
COMMITTEE ON APPROPRIATIONS
COMMITTEE ON GOVERNMENTAL AFFAIRS

June 11, 1984

District Engineer
U.S. Army Corps of Engineers, Mobile
P.O. Box 2288
Mobile, Alabama 36628

Re: The Draft Generic Environmental Impact Statement for Exploration and Production of Hydrocarbon Resources in Coastal Alabama and Mississippi

Dear Sir

I have been advised that on June 14, 1984 a public hearing will be held by the U.S. Army Corps of Engineers on the above-referenced draft environmental impact statement.

While I have not had the opportunity to review this proposed document and will not attempt to comment on its substance, I do wish to express generally my interest in and support for the exploration and development of our offshore energy resources.

Your efforts to draft a general permit to facilitate the long-term development of these resources is commendable, particularly when the current unrest in the Persian Gulf threatens to disrupt oil and gas supplies. Our national security demands that we act to lessen our dependence on imported energy supplies by continuing to develop domestic fields. The U.S. Geological Survey estimates that offshore drilling could provide as much as 56% of our future domestic crude oil and 36% of our future natural gas supplies. Because of the long lead time required for developing offshore fields, it is important that we act now. 1-1

Development of our offshore resources also means important revenues for the Gulf Coastal states as well as jobs directly in the oil industry and indirectly in those industries servicing the producing companies.

I must also state my concerns that the development of our offshore resources must be conducted in an environmentally safe manner, but I believe that the industry has demonstrated its ability to find oil and gas when given the opportunity with little adverse impact on wetlands, estuaries, and other environmentally sensitive areas.

RESPONSE TO COMMENTS

1-1. The letter of support is acknowledged. The U.S. Army Corps of Engineers and other cooperating agencies participating in the Generic EIS process also recognize the importance of expeditious development of our energy resources while providing reasonable protection to our environmental resources.

District Engineer
June [illegible]
Page [illegible]

I therefore urge you to continue with the development of a general permit with reasonable environmental controls which will expedite the development of our offshore resources while providing important safeguards for the environment. 1-1 cont.

Thank you for your consideration in this matter.

Sincerely,

Thad Cochran

THAD COCHRAN
United States Senator

TC:jw

Congress of the United States
House of Representatives
Washington, D.C. 20515

[illegible] will [illegible] conduct a public hearing [illegible] permits for offshore [illegible] indications of interest in off- [illegible] County, Mississippi. I would like to [illegible] participate [illegible] hearings.

[illegible] represent a huge economic pote[illegible] [illegible] like, however, that econ[illegible] [illegible] with environmental concerns.

[illegible] the Corps to make every effort to [illegible] [illegible] to these sometimes conflicti[illegible] [illegible] effort is at the heart of these hearin[illegible], and I would [illegible] your findings.

Sincerely yours,

Trent Lott

2-1

RESPONSE TO COMMENTS

2-1. The comments are acknowledged.

LETTER 1

United States Department of Agriculture

Soil Conservation Service

P. O. Box 311
Auburn, Alabama
36830

JUN 15 1984

Mr. Lawrence R. Green
Chief, Planning Division
Department of the Army
Mobile District, Corps of Engineers
P. O. Box 2288
Mobile, AL 36628

Dear Mr. Green:

RE: Exploration and Production of Hydrocarbon Resources in Coastal Alabama and Mississippi Draft Generic Environmental Impact Statement.

This is in response to your request for review of the above referenced environmental impact statement.

Members of my technical staff have reviewed the statement and have no comments to offer.

We appreciate the opportunity to review this statement.

Sincerely,

William C. Thompson for

Ernest V. Todd
State Conservationist

Letter [illegible]

United States Department of Agriculture

Soil Conservation Service

[illegible]
100 [illegible]
Jackson, [illegible]

June 7, 1984

Mr. Lawrence R. Green, Chief
Planning Division
Department of the Army
Mobile District Corps of Engineers
P. O. Box 2288
Mobile, Alabama 36628

Dear Mr. Green:

We have reviewed your report, "Exploration [illegible] Hydrocarbon Resources in Coastal [illegible]" the draft Generic Environmental Impact St[illegible]

The proposed plans for this work do not [illegible] agency. We have reviewed the potential [illegible] impacts and agree with the discussion of these [illegible] will significantly [illegible]

We appreciate the opportunity for review and com[illegible]

Sincerely,

[illegible] Acting

A. E. Sullivan
State Conservationist

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

May 21, 1984

Colonel Patrick J. Kelly
District Engineer
Corps of Engineers - Mobile District
Department of the Army
P.O. Box [illegible]
Mobile, AL 36628

Dear Colonel Kelly:

This is in reference to your draft environmental impact statement for exploration and production of hydrocarbon resources in coastal Alabama and Mississippi. Enclosed are comments from the National Oceanic and Atmospheric Administration.

We hope our comments will assist you. Thank you for giving us an opportunity to review the document. We would appreciate receiving [illegible] copies of the final environmental impact statement.

Sincerely,

Joyce M. Wood
Chief, Ecology and
Conservation Division

Enclosure

DC:das

LETTER 5 (cont.)

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Region
9450 Koger Boulevard
St. Petersburg, FL 33702

May 18, 1984 F/SER11/AM
813-893-3503

Colonel Patrick J. Kelly
District Engineer, Mobile District
Department of the Army, Corps of Engineers
P.O. Box 2288
Mobile, AL 36628

Dear Colonel Kelly:

The National Marine Fisheries Service (NMFS) has received the Draft Environmental Impact Statement (DEIS) for exploration and production of hydrocarbon resources in coastal Alabama and Mississippi, dated April 1984. We have reviewed the DEIS and offer the following comments for your consideration.

General Comments

The discussion on endangered and threatened species in Mississippi Sound (page 3-71, paragraph 3.170) should include the loggerhead (threatened), green (threatened) and Kemp's ridley (endangered) sea turtles. Table 3.20 (page 3-74) should be expanded accordingly. The listing of endangered whales for Alabama and Mississippi State waters of the Gulf of Mexico (page 3-90, paragraph 3.213) should include the right whale (*Eubalaena glacialis*). This should be reflected in Table 3-27 (page 3-92). 5-1

The DEIS should also discuss the effects of the proposed actions on endangered/threatened species under the purview of the NMFS. These are:

- green sea turtle
- hawksbill sea turtle
- Kemp's ridley sea turtle
- leatherback sea turtle
- loggerhead sea turtle
- blue whale
- right whale
- sei whale
- humpback whale
- fin whale
- sperm whale

A Section 7 consultation pursuant to the Endangered Species Act of 1973 eventually will be required for hydrocarbon exploration and development 5-2

RESPONSE TO COMMENTS

5-1. The text has been revised to reflect this comment.

5-2. Suggested additions have been made to the endangered species list [illegible] discussions have been included in the final EIS implementing [illegible] with the National Marine Fisheries Service and the Fish and Wildlife [illegible] Coordination will continue for specific permit application.

activities. Accordingly, the FEIS would be an appropriate document to include a biological assessment of potential effects of the proposed action on endangered/threatened species. 5-2 cont

Sincerely yours,

Richard J. Hoogland
Chief, Environmental Assessment Br

LETTER 6

United States Department of the Interior
FISH AND WILDLIFE SERVICE
P. O. Drawer 1197
Daphne, AL 36526

June 20, 1984

Colonel Patrick J. Kelly
District Engineer
Mobile [illegible] of Engineers
[illegible]
Mobile, [illegible]

Dear Colonel Kelly:

This letter provides a response to Public Notice No. 2GO02 dated April 24, 1984. The Mobile District, Corps of Engineers, proposes to issue a General Permit for hydrocarbon exploratory/appraisal drilling activities in [illegible] and Alabama/Mississippi offshore water. Our report is submitted under provisions of the Fish and Wildlife Coordination Act [illegible], as amended; 16 U.S.C. 661 et seq.).

[illegible] Fish and Wildlife Service (FWS) has cooperated closely with the [illegible] in development of the proposed general permit and [illegible] Environmental Impact Statement. Cooperation of [illegible] to [illegible] a draft General Permit which the FWS [illegible] activities which could be conducted under authority of [illegible] would produce no significant impacts to fish and wildlife [illegible] that full compliance takes place with the conditions [illegible] contained within the permit. These conditions are [illegible] part of safeguarding important public resources.

Our [illegible] recommendation pertains to Special Condition I.F. on page [illegible] condition for the proposed General Permit is appropriate [illegible] that a specific schedule should be set for [illegible] noted here. The details for these [illegible] established at this time. We believe that at a minimum [illegible] be reviewed on a two year basis. 6-1

[illegible] these comments is appreciated.

Sincerely,

[illegible]
Field Supervisor

RESPONSE TO COMMENTS

6-1. Comment noted. This will be taken into consideration in further processing the General Permit.

LETTER 7

United States Department of the Interior
FISH AND WILDLIFE SERVICE
JACKSON MALL OFFICE CENTER
300 WOODROW WILSON AVENUE, SUITE 3185
JACKSON, MISSISSIPPI 39213

May 17, 1984

IN REPLY REFER TO:
Log No. 4-3-84-536

Mr. Lawrence R. Green
U.S. Army, Corps of Engineers
Post Office Box 2298
Mobile, Alabama 36628

Dear Mr. Green:

This responds to your letter of April 24, 1984, concerning a DEIS for Exploration and Production of Hydrocarbon Resources in Coastal Alabama and Mississippi. We have reviewed the information you enclosed relative to the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.).

Since this project is a major Federal action significantly affecting the quality of the human environment (i.e., one requiring an environmental impact statement), Section 7(c) of the Endangered Species Act, as amended, requires that you prepare a biological assessment to determine the effects of the project on listed and proposed species. The biological assessment shall be completed within 180 days after the date on which initiated and before any physical modification of the environment is begun. If the biological assessment is not begun within 90 days, you should verify the species list informally (via phone) prior to initiation of your assessment. When conducting a biological assessment, you shall, at a minimum:

1. conduct a scientifically sound on-site inspection of the area affected by the action, which must include a detailed survey of the area to determine if listed or proposed species are present or occur seasonally and whether suitable habitat exists within the area for either expanding the existing population or potential reintroduction of populations; 7-1

2. interview recognized experts on the species at issue, including those within the Fish & Wildlife Service, the National Marine Fisheries Service, state conservation agencies, universities, and others who may have data not yet found in scientific literature;

3. review literature and other scientific data to determine the species distribution, habitat needs, and other biological requirements;

RESPONSE TO COMMENTS

7-1. See response to letter number 5, National Marine Fisheries Service. Impacts have been assessed at the Generic level and will be further addressed through the permit process for specific actions.

4. [illegible] the effects of the action on individuals and populations of [illegible], including cumulative effects of the action;

5. analyze alternative actions that may provide conservation measures;

6. conduct any studies necessary to fulfill the requirements of (1) through [illegible] above;

7. review any other relevant information. | 7-1 cont.

[illegible] that the proposed action may affect any of the listed [illegible] or is likely to [illegible] the continued existence [illegible] result in the destruction or adverse modification [illegible] the proposed [illegible] such species, you must request [illegible] consultation pursuant to Section 7(a) from our office.

If [illegible] further information from our office regarding this project, [illegible] contact our office, telephone 601/960-4900.

We [illegible] participation in the efforts to enhance the existence of endangered species.

Sincerely yours,

for James [illegible]

[illegible] B. Jordan
Field Supervisor
Endangered Species Field Office

[illegible] Game and Fish, Montgomery, AL
[illegible]
[illegible]

LETTER 8

United States Department of the I[illegible]erior

OF[illegible] OF ENVIRONMENTAL PROJECT RE[illegible]W

Southeast Region [illegible]60

[illegible]ng

75 Spring Street, S.W. Atlanta, Ga 30303

Telephone 404 221-4524 FTS 242-4524

JUN 2 0 1984

[illegible] [illegible]own, Chief

[illegible] Corps of Engineers

[illegible] Army

[illegible] 36628

[illegible] Interior has reviewed the draft Environmental Impact [illegible] Exploration and Production of Hydrocarbon Resources in [illegible] Mississippi (2 vols.). Our comments follow.

[illegible]

[illegible] 47,400 acres identified as all or part of 26 blocks of [illegible] is located in the Mississippi Sound. These Outer [illegible] blocks, referred to as the Mississippi Sound Enclaves, [illegible] in the Draft EIS. 8-1

[illegible] and transport of oil spills are assessed, but the probability [illegible] is not discussed. The potential for an oil spill would [illegible] vital to the impact assessment, particularly in light of [illegible] geographic settings of coastal Alabama and Mississippi. 8-2

[illegible] would like to see all Federal onshore and offshore lands [illegible] and clearly indexed in the EIS. If any potential activity [illegible] Federal lands and/or resources, we would appreciate the [illegible] to review and comment on any proposal prior to initiation of [illegible] near the aforementioned lands and/or resources. In [illegible] the Bureau of Land Management (BLM) requests this [illegible] when BLM-administered lands, as per the enclosed list, [illegible] potentially be impacted. 8-3 8-4

[illegible], the draft EIS indicates that the barrier islands of the [illegible] Islands National Seashore (NS) (including Horn, Ship, and Petit Bois [illegible] extensive areas for seaside and soundside water-related [illegible]. Chapters [illegible] and 6 of the draft EIS go on to describe the [illegible] consequences of unit actions in Mobile Bay/Mississippi Sound [illegible] state waters of the Gulf of Mexico, respectively. However, it is [illegible] two chapters to specifically ascertain the type, [illegible] and probability of impacts to the water resources of [illegible]. Given the importance of water quality and other [illegible] to the Gulf Islands NS, we recommend the [illegible] in the draft EIS as to the potential [illegible] a result of the proposed unit actions. 8-5

RESPONSE TO COMMENTS

8-1. The maps have been revised to show the Mississippi Sound Enclaves.

8-2. Spill probabilities vary greatly for different technologies and different environmental settings. For well blowouts and pipeline ruptures, the reader is referred respectively to probabilities given on pages 4-86 (Paragraph 4.314) and 4-120 (Paragraph 4.509) of the Draft GEIS.

8-3. All federal offshore waters are identified in the EIS. Most federal onshore areas are outside the boundaries of the study area.

8-4. Comment noted. The Bureau of Land Management will be given opportunity to comment on any future permit applications that could potentially affect federal lands.

8-5. In Mississippi, no drilling would be allowed within one mile of any shoreline. In Alabama, no drilling would be allowed within one mile of the shoreline of the Gulf of Mexico or within one-half mile of the shoreline in Mobile Bay or Mississippi Sound. The only direct impacts could then result from placement of pipelines and use of service boats (if service boats come ashore at any of the barrier islands). All activities would be in concurrence with current regulations protecting national seashores. For impacts on surface water resources of Horn, Ship and Petit Bois Islands, readers are referred to discussions of gathering system construction and effects of spilled fluids which could migrate to barrier island shorelines. Service boat discharges must adhere to Coast Guard regulations (see comment 23-10).

Mr. Lawrence R. Green 2

5. With regard to Conditions and Limiting Factors, attached to the proposed General Permit for Hydrocarbon Exploratory/Appraisal Drilling Activities in Mobile Bay/Mississippi Sound and Alabama/Mississippi Offshore Waters, there should be some clarification as to what consideration has been given to the proximity of operations to the Gulf Islands NS. 8-6

6. The proposal's consistency with the State Coastal Zone Management Program is not addressed. 8-7

7. Much of this document is made up of large complex tables and figures. Some reference to principal sources and/or reference to an appropriate appendix would document the basis for the information displayed. 8-8

8. Some of the terms used in the draft EIS are defined in the text when they are first used. A glossary of terms would be useful to the reader, considering the size of the document and the difficulty in finding first-used terms. 8-9 In addition, an expansion of the present index would also increase the usability of the document, especially if the indexing of locations within the source area is increased. 8-10

Specific Comments

1. Items 2.14 and 2.15 of Executive Summary: In addition to the Corps of Engineers National Environmental Policy Act (NEPA) procedures described in the document, the BLM NEPA analysis for hydrocarbon activities on BLM lands should also be noted. For oil and gas actions on BLM lands (see enclosed list), the current practice is that Environmental Assessments (EA's) and EIS's are prepared for those applications for onshore operations which have been processed through the Categorical Exclusion Review (CER) process to determine the necessity to prepare EA's and EIS's. Items 2.14 and 2.15 do not note this fact. Because hydrocarbon activities on BLM lands are subject to a CER, it is not always necessary to prepare an EA or EIS for each application. Doing so would result in unnecessary delays of permit issuance. 8-11

We appreciate the opportunity to review and comment on the subject document. We also hope that these comments will be helpful to you in preparing a final EIS

Sincerely,

James H. Lee

James Lee
Regional Environmental Officer

Enclosure

RESPONSE TO COMMENTS

8-6. The GEIS has assessed potential impacts to all barrier [illegible] including those of the Gulf Islands N[illegible] An assessment [illegible] construction across barrier islands has been added to [illegible] environmental value and sensitivity has been [illegible] surrounding waters as indicated in chapter [illegible] #9.

8-7. The CEIS does not present a specific proposal [illegible] determination would be required. Both Alabama and M[illegible] encourage mineral resource exploration and [illegible] the State coastal zone management agency. Specific [illegible] within the coastal zone require coastal zone consistency [illegible]

8-8. The text refers to reference material cited in the Ref[illegible] section. References to appropriate appendices are [illegible]

8-9. Comment noted. The District recognizes the difficulty [illegible] specialized terms in a document intended for the gen[illegible] specialized terms has been kept to a minimum in this [illegible]

8-10. Comment noted. The use of [illegible] detailed table of contents [illegible] should help the reader find material of interest in the [illegible]

8-11. Comment noted. Paragraphs 2.14 and 2.15 in the Executive Summary [illegible] Corps of Engineers would handle permit applications during the p[illegible] of the draft and final EIS. This has no impact on BLM permitting [illegible] Other federal agencies would still be included in the review process

According to Our Most Current Information, The Following
BLM Public Lands Occur in Your EIS Study Area:

STATE	COUNTY	MERIDIAN	T.	R.	SEC.	SUBDIVISION	ACRES
MS	Jackson	St. Helena	9S	6W	3	Lot 2	16.54
MS	Jackson	St. Helena	9S	6W	4	Lot 1	32.44
AL	Baldwin	St. Stephens	9S	1E	25	Lot 5	10.20
AL	Baldwin	St. Stephens	9S	1E	25	Lot 24	0.04
AL	Baldwin	St. Stephens	9S	1E	26	Lot 13	2.71
AL	Baldwin	St. Stephens	9S	1E	26	Lot 14	2.61
AL	Baldwin	St. Stephens	9S	1E	26	Lot 15	9.96
AL	Baldwin	St. Stephens	9S	2E	25	Lot 73	6.22
AL	Baldwin	St. Stephens	9S	2E	25	Lot 74	5.62
AL	Baldwin	St. Stephens	9S	2E	27	Lot 54	5.82
AL	Baldwin	St. Stephens	9S	2E	27	Lot 55	5.36
AL	Baldwin	St. Stephens	9S	2E	27	Lot 56	4.75
AL	Baldwin	St. Stephens	9S	2E	28	Lot 43	8.88
AL	Baldwin	St. Stephens	9S	2E	28	Lot 44	7.49
AL	Baldwin	St. Stephens	8S	3E	5	Frl. Sec.	13.96
AL	Mobile	St. Stephens	4S	4W	12	SE1/4 NE1/4	40.35
AL	Mobile	St. Stephens	7S	2W	25	Lot 2	8.53
AL	Mobile	St. Stephens	7S	2W	25	Lot 3	17.98
AL	Mobile	St. Stephens	7S	2W	25	Lot 4	9.78
AL	Mobile	St. Stephens	7S	2W	25	Lot 5	5.62
						Total Acreage	215.18

LETTER 9

US Department of Transportation
Office of the Secretary of Transportation

400 Seventh St. S.W.
Washington, D.C. 20590

Mr. Lawrence R. Green
Chief, Planning Division
Department of the Army
Mobile District, Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628

Dear Mr. Green:

Your recent letter requests information and any comments from this Department on the Exploration and Production of Hydrocarbon Resources in Coastal Alabama and Mississippi.

Regional Representatives of the Secretary coordinate departmental comments on environmental impact statements (prepared by other agencies) that impact only one region and that may involve more than one DOT administration.

Accordingly, your letter has been referred to Edward La Mar Baker, Suite 515, 1720 Peachtree Road, N.W., Atlanta, GA 30309. Thank you for the oportunity to comment.

Sincerely,

Eugene L. Lehr, Chief
Environmental Division
Office of Economics

LETTER 10

U.S. Department of Transportation
Federal Aviation Administration

Southern Region

ASO-4
P. O. Box 20636
Atlanta, Georgia 30320

Mr. Lawrence R. Green
Chief, Planning Division
Mobile District
Corps. of Engineers
P. O. Box 2288
Mobile, Alabama 36628

May 11, 1984

Dear Mr. Green:

RE: DEIS - Exploration and Production of Hydro-carbon Resources in Coastal Alabama and Mississippi.

The Federal Aviation Administration has reviewed the subject DEIS and has no comments on the substance of the document.

We would caution, however, that if proposed extraction operations occur in the immediate vicinity of a public use airport, that this agency be contacted before the issuance of any permits. 10-1

Sincerely,

Robert T. Francis, II
Manager,
Program Evaluation and
International Staff

RESPONSE [illegible] MENTS

10-1. Comment noted. The Federal Aviation Administration w[illegible] review any permit applications that could potentially [illegible] airports.

LETTER 11

U.S. Department
of Transportation
Federal Highway
Administration

Alabama Division Office

441 High Street
Montgomery, Alabama 36104

May 21, 1984

IN REPLY REFER TO

HEC-AL

Mr. Lawrence R. Green
Chief, Planning Division
Department of the Army
Mobile District, Corps of Engineers
P. O. Box 2288
Mobile, Alabama 36628

Dear Mr. Green:

Subject: DEIS - Exploration and Production
of Hydro-Carbon Resources in
Coastal Alabama and Mississippi

Your letter dated April [illegible], 1984, transmitted the subject DEIS for our review and comments.

We have completed our review of the subject DEIS and do not have any comments to offer. Also, the State of Alabama Highway Department has indicated they do not have any comments to offer.

Sincerely yours,

Joe D. Wilkerson
Division Administrator

Washington DC
Staff Symbol: G-WP-1
Phone: (202) 426-9584

0317

22 MAY 1984

... of Engineers

... the Department of Transportation ... Coastal Impact Statement concerning Exploration ... Resources in Coastal Alabama and Mississippi. ... following comments:

... The National Oil and Hazardous Substances Contingency ... the Environmental Protection Agency (EPA), ... Environmental Quality. In addition, Federal ... within the study area should be ... title and areas of responsibility. 12-1

... should be noted that the Pollution Revolving Fund is ... operations only in cases where the responsible ... appropriate action. The responsible party would ... cleanup costs incurred by the Federal 12-2

... regarding ... plans do not appear to be ... with requirements provided in 40 CFR 112. 12-3

... Coast Guard Strike Team (GST) will be relocating ... to Mobile, AL within the next six (6) months. 12-4
... party responsible for a spill would be liable for any ... the GST. Finally, the specific equipment ... for the GST may not be valid. It would be more ... general statement indicating that they are ... oil spills over a variety of inshore and ... 12-5 12-6

... of response times for the organizations ... 12-7

... Draft Environmental Impact

Sincerely,

... Coast Guard
... and Evaluation

... the Commandant

RESPONSE TO COMMENTS

12-1. The text has been revised to indicate the EPA as author of the National Oil and Hazardous Substances Contingency Plan. The on-scene coordinators and other officials to contact in case of spill or other emergency are identified in each contingency plan prepared by an applicant. For the study area, EPA has emergency response responsibility above the I-65 highway bridge across the Mobile River Delta; the Coast Guard has this responsibility in all other portions of the study area.

12-2. The text has been revised to indicate that the Pollution Revolving Fund applied to cases where the responsible party is not taking appropriate action.

12-3. The text has been revised to be in accordance with 40 CFR 112.

12-4. The text has been revised to note the planned relocation of the Coast Guard Strike Team.

12-5. The text has been revised to include the cost liability of responsible parties.

12-6. The text has been revised to include a more general statement concerning equipment available to the Coast Guard Strike Team.

12-7. Response times by industry are specified in their contingency plans prepared for the state and vary considerably.

LETTER 13

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

Captain of the Port
1900 First National Bank
P. O. Box 2924
Mobile, AL 36652
205-690-2286

16600
4 June 1984

Department of the Army
Corps of Engineers
PO Box 2288
Mobile, AL 36628

Sub: PROPOSED GENERAL PERMIT FOR HYDROCARBON EXPLORATORY/APPRAISAL DRILLING ACTIVITIES IN MOBILE BAY, MISSISSIPPI SOUND, AND ALABAMA/MISSISSIPPI OFFSHORE WATERS

Ref: (a) Public Notice No. MD602

Reference (a) concerning the proposed general permit guidelines for hydrocarbon exploratory/appraisal drilling activities in Mobile Bay, Mississippi Sound, and Alabama/Mississippi offshore waters has been reviewed by this office in the interest of maritime safety and environmental protection. This office voices no objections to these proposed guidelines except as noted in the following comments.

There are no statutory requirements enforced by the Coast Guard for a company to submit a project specific oil spill contingency plan and blowout prevention plan to the Coast Guard for approval. In accordance with a Memorandum of Understanding with the U.S. Geological Service, the Coast Guard does review for adequacy, but does not approve, oil spill contingency plans for rigs located on the outer continental shelf. If the states of Alabama or Mississippi have established criteria for the content of such contingency plans, this office would be happy to assist in their review or to assist in the development of the criteria, should guidelines become mandated. 13-1

Notwithstanding, if a contingency plan is to be required, its content might include a risk analysis, recovery equipment requirements, equipment availability, notification procedures, response time, response procedures, and philosophy for conducting drills and training of personnel. 13-2

Gas blowout prevention plans are neither required nor reviewed by the Coast Guard. 13-3

For your information, the Minerals Management Service located at:

3301 N. Causeway Blvd, Suite 643
Post Office Box 7944
Metairie, Louisiana 70010
Telephone FTS: 680-9217

should be consulted for possible safety guidelines concerning H_2S and pipelines. For additional safety guidelines concerning pipelines, you may also wish to seek information from 13-4

RESPONSE TO COMMENTS

13-1. Comment noted. Chapter 13 has been revised accordingly.

13-2. Comment noted.

13-3. Comment noted.

13-4. Comment noted.

16600
4 June 1984

[illegible] EXPLORATORY/APPRAISAL DRILLING
[illegible], AND ALABAMA/MISSISSIPPI

[illegible] (a) for not permitting rigs in [illegible] 500 feet of other navigation channels and [illegible] 162.75(b)(2) of Title 33, Code of [illegible] Commander may specify the width [illegible] waterways under his charge." Since some [illegible] Coastal Waterway have no specified [illegible] 13-14 cont. 13-4 cont.

[illegible] this matter, please feel free to [illegible] number. A representative [illegible] on the matter scheduled for

Sincerely,

W. J. [illegible]
Captain, USCG
Captain of the Port

2

LETTER 14

SENATE CHAMBER

MONTGOMERY, ALABAMA 36130

ALABAMA

EARL GOODWIN
STATE SENATOR 24TH DISTRICT
P. O. BOX 884
SELMA
36701
(205) 872-7241

COMMITTEES
VICE CHAIRMAN FINANCE AND TAXATION
GENERAL FUND SUB COMMITTEE
GOVERNMENTAL AFFAIRS
AGRICULTURE CONSERVATION AND FORESTRY
COMMITTEE ON AGING
SMALL BUSINESS

June 25, 1984

Col. Patrick J. Kelly
Mobile District Engineer
U. S. Army Corps of Engineers
P. O. Box 2288
Mobile, Alabama 36628

Dear Col. Kelly:

The attached resolution was approved by the Alabama Oil and Gas Study Committee on June 21, 1984. This resolution requests that the Mobile District Corps of Engineers' proposed Generic EIS and proposed General Permit MDG02 be fully consistent with, and no more stringent than, Federal offshore regulations and the regulations, policies, and practices of the State of Alabama regulatory agencies.

In the interest of the citizens of the State of Alabama this Committee respectfully requests your immediate consideration of this resolution.

Sincerely,

Earl Goodwin
cse

Earl Goodwin
Chairman
Alabama Oil and Gas Study Committee

EG/csr

enc.

cc: Gov. George Wallace
Lt. Gov. Bill Baxley
Speaker of the House of Representatives Tom Drake
Alabama Congressional Delegation
Alabama Department of Conservation and Natural Resources
Alabama Oil and Gas Board
Alabama Department of Environmental Management

RESOLUTION OF THE ALABAMA OIL AND GAS STUDY COMMITTEE

REQUESTING THAT THE U.S. ARMY CORPS OF ENGINEERS, MOBILE DISTRICT AND COLONEL PATRICK J. KELLY, MOBILE DISTRICT ENGINEER, REVISE DEPARTMENT OF THE ARMY, MOBILE DISTRICT CORPS OF ENGINEERS PROPOSED GENERIC EIS AND PROPOSED GENERAL PERMIT MOGO2, TO BE FULLY CONSISTENT WITH, AND NO MORE STRINGENT THAN FEDERAL OFFSHORE REGULATIONS AND THE REGULATIONS, POLICIES AND PRACTICES OF THE STATE OF ALABAMA REGULATORY AGENCIES

WHEREAS, the Alabama Legislature, by Joint Resolution 256 of the 1963 Legislative Session, created this Committee, known as the "Alabama Oil and Gas Study Committee" as a permanent joint committee to study the oil and gas industry in Alabama

WHEREAS, the State of Alabama is very interested in the expeditious, orderly and environmentally responsible exploration, development and production of the hydrocarbon resources underlying its coastal lands and waters; and

WHEREAS, the Alabama Legislature, by Joint Resolution 238, has expressed its intent and established law and public policy to the effect that Alabama Offshore Environmental Rules be consistent with, but not more stringent than Federal Offshore Environmental Regulations; and

WHEREAS, the State of Alabama, through ownership of Alabama submerged lands is in direct competition with other states and the Federal Government for lease bonuses and mineral development on these lands; and 14-1

WHEREAS, the U. S. Army Corps of Engineers, Mobile District, has published four separate Final Environmental Impact Statements and one Environmental Assessment for Hydrocarbon Activities in Mobile Bay and the Mobile River Delta in 1975, 1980, and 1982 (EIS and Environmental Assessment), and

WHEREAS, the U. S. Army Corps of Engineers, Mobile District, has published in May 1984 a Draft Generic Environmental Impact Statement for Hydrocarbon Activities in Alabama and Mississippi Coastal Waters, including the Mobile River Delta, and

WHEREAS, the May 1984 Draft Generic Environmental Impact Statement, although intended to be an objective and analytical statement of the environmental effects that could be expected from granting or denying 14-2

RESPONSE TO COMMENTS

14-1. This is background information and as such no response is required.

14-2. While this comment does not reference any particular sections of the EIS, as discussed in response to other comments, the EIS has been modified where appropriate to better state the relative significance of environmental impacts and additional economic information has been added to the EIS (see response letter 23a).

the proposed general permit, is deficient in that it: (1) overstates physical impacts of little environmental consequence, while understating economic impacts of major consequences such as creation of jobs and revenues, (2) fails to consider the environmental effects if drilling mud and cuttings were to be discharged into the water as is the practice in adjacent Federal OCS waters and in certain other states, and (3) fails to consider the effects of not backfilling pipeline trenches, barge slips and access canals, and of allowing construction activities for siting drill rigs or pipelines in certain areas such as grass beds, oyster beds, barrier islands and spawning areas; and 14-2 cont. 14-3 14-4 14-5

WHEREAS, the aforementioned six separate environmental studies all conclude that offshore hydrocarbon activities can exist in harmony with the environment, and without producing any significant long term adverse environmental impacts, and

WHEREAS, extended time delays in obtaining permits from the Mobile District Corps of Engineers have had a negative effect on the exploration, development and production of Alabama's offshore hydrocarbon resources; and

WHEREAS, the U. S. Army Corps of Engineers, Mobile District, has proposed General Permit MDG02 for certain hydrocarbon activities in Alabama and Mississippi coastal waters; and

WHEREAS, the proposed general permit is severely limited in coverage because it does not apply to necessary activities in the hydrocarbon recovery process beyond the drilling phase and it does not apply to any activity in the Mobile River Delta; and 14-6

WHEREAS, the proposed general permit places very limiting restrictions on drilling activities; and

WHEREAS, said limiting restrictions are not warranted by environmental findings; are inconsistent with current regulations, policies and practices of the Alabama Department of Conservation and Natural Resources and the Alabama Oil and Gas Board, and are more stringent than restrictions contained in U. S. Army Corps of Engineers nationwide permit (33 CFR 330.5) for hydrocarbon activities on U. S. Government Outer Continental Shelf Leases; and

-2-

RESPONSE TO COMMENTS

14-3. As stated in Chapter 2 impact analysis in the DEIS is based upon the assumption that no discharge will be allowed of drilling fluids, cuttings, formation waters, contaminated wastewaters or contaminated rainwater runoff into waters of the study regions which at that time was the policy of both Alabama and Mississippi. If either state changes its policy further environmental analysis can be performed based upon the specifics of proposed permit action.

14-4. As stated in Chapter 2, for impact analysis, it is assumed that pipeline trenches and dredged access canals will be backfilled as is the current policy of the [illegible] Corps of Engineers Mobile District. Specific permit actions will [illegible] determine if the policy should be changed and if additional [illegible] analysis is required.

14-5. As stated in Chapter 2, for impact analysis, it is assumed that [illegible] structures in wetland and aquatic areas will be [illegible] will be used for pipelines. As noted in response [illegible] the EIS, (see response 23-3) the EIS has been modified [illegible] reflect the impact of siting structures in wetlands, oyster reefs, [illegible] islands. Depending upon the specifics of future permit requests, [illegible] environmental analysis may be required.

14-6. These comments relate to the Corps of Engineers [illegible] General permit and will be taken into consideration [illegible] not to issue a General Permit. It is noted, however, that [illegible] conditions of a general permit [illegible] individual permit from the Corps of Engineers [illegible] necessary, would be made based upon the specifics [illegible]

WHEREAS, proposed General Permit MDG02 if adopted without modification, would discourage, not encourage, exploration, development, and production of Alabama's coastal hydrocarbon resources; now therefore

BE IT RESOLVED BY THE ALABAMA OIL AND GAS STUDY COMMITTEE, That the Committee strongly recommends and urges the U. S. Army Corps of Engineers, Mobile District, and Colonel Patrick J. Kelly, Mobile District Engineer, to revise proposed General Permit MDG02 so as to:

1. Be in accord with the public policy and law of the State of Alabama as established by Joint Resolution 238, Act 83-609, passed by the 1983 regular session of the Alabama Legislature providing that Alabama Offshore Environmental Rules be consistent with, but not more stringent than Federal Offshore Environmental Regulations, and

2. Be fully consistent with and no more stringent than the regulations, policies and practices of the Alabama Department of Conservation and Natural Resources and the Alabama Oil and Gas Board, especially with respect to offset distance from shorelines, oyster beds, grass beds, platforms, wellheads, drilling rigs and other structures; and 14-6 cont.

3. Contain restrictions no more stringent than U. S. Army Corps of Engineers Nationwide Permit for Hydrocarbon Exploration, Development and Production Activities on U. S. Government Outer Continental Shelf Leases, as set forth in 33 CFR 330.5; and

4. Apply to necessary activities in the offshore hydrocarbon recovery process beyond the drilling phase; and

5. Apply to hydrocarbon activities in the Mobile River Delta.

BE IT FURTHER RESOLVED, That the Committee strongly recommends and urges the Corps of Engineers to revise the Draft Generic Environmental Impact Statement to: (1) give balanced treatment to all potential impacts, (2) consider the environmental effects of discharging drilling mud and cuttings into the water, and (3) consider the effects of construction activities in certain areas for purposes of siting drill rigs or laying pipelines. 14-7

BE IT FURTHER RESOLVED, That the Committee strongly recommends and urges the Corps of Engineers to consider amending proposed General 14-8

-3-

RESPONSE TO COMMENTS

14-7. See response to comments 14-2, 14-3, 14-4 and 14-5.

14-8. See response to comment 14-6.

Permit #DC-?? to apply only to Alabama coastal waters. This will assure that the regulations, policies and practices of individual states will be given proper weight in the permitting of hydrocarbon activities in their respective coastal waters. 14-8 cont.

RESOLVED FURTHER, That copies of this resolution be forwarded to the Governor of the State of Alabama, the President of the Alabama Senate, and the Speaker of the Alabama House of Representatives, to all United States Senators and United States Representatives from the State of Alabama, the Alabama Department of Conservation and Natural Resources, the Alabama Oil and Gas Board, and the Alabama Department of Environmental Management 14-9

Senator Earl Goodwin, Chairman

Representative Mike Onderdonk, Vice-Chairman

Senator Bill Menton

Senator Bill Smith

Representative Max Newman

Representative J. E. Turner

Mr. Joe Bethea

Mr. Steve Harrison

Mr. [illegible] Joyner

Mr. [illegible]

4

RESPONSE TO COMMENTS

14-9. Comment noted, no further response necessary.

LETTER 15

STATE OF ALABAMA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
[illegible]

May 15, 1984

DIVISION OF GAME AND FISH
CHARLES D. KELLEY
DIRECTOR

SAM L. SPENCER
ASSISTANT DIRECTOR

District Engineer
U. S. Army Engineer District
P. O. Box [illegible]
Mobile, AL [illegible]

ATTENTION: Regulatory Branch

Dear Sir:

This is in reference to Public Notice MD[illegible], dated April, 1984, concerning a Draft Generic Environmental Impact Statement, Exploration and Production of Hydrocarbon Resources in Coastal Alabama and Mississippi.

The Game and Fish Division of the Alabama Department of Conservation and Natural Resources reviewed the above document and find it covers game and fish concerns for the environment and involved resources. Item 7, Page VIII, in the Summary section of the draft references these concerns.

The loss of wetland areas to the various construction activities and the ever present threat of oil spills, pipeline breaks, and well blowouts could prove disastrous to important fish, shellfish and wildlife resources dependent on the environment. These resources include resident as well as migratory species. Waterfowl populations involved are of continental concern as are many species of a nongame nature. Any loss of habitat for fish and wildlife will be reflected in the local economy. Sport hunting, fishing and nonconsumptive wildlife activities represent substantial income to the local economy that is spread over a wide spectrum of the business community. Marine commercial fisheries supports a major industry in the local area and is dependent on the adequate function of bay and delta as desirable spawning and nursery habitat. 15-1

The study area represents Alabama's entire bay and coastal ecosystem. It presently supports heavy recreation use by Alabama and out-of-state [illegible]. This increasing use could be affected should the environment become degraded. The economic value of such use is important to the local economy and its loss would certainly affect employment in the two-county area.

It is important to provide adequate [illegible] these natural resources that are renewable [illegible] the recovery of non-renewable [illegible] A [illegible] will provide for continuous annual

RESPONSE TO COMMENTS

15-1. Comment noted.

District Engineer
May 15, 1984
Page 2

supplies of fish, shellfish, waterfowl, furbearers and timber. In addition, it will attract continuous non-consumptive use of these and the nongame species. In contrast, hydrocarbon resources are exhaustable in a very short time frame. 15-1 cont.

The Corps and cooperating agencies are to be commended on the decision to not allow the use of general permits in the Mobile Delta. The decision to restrict their use to specific activities in only selected portions of the bay, sound and coastal waters could provide protection for important environmental features of the overall ecosystem.

We feel very strongly that the final Environmental Impact Statement should contain detailed contingency plans for use in the event of oil spills, pipeline breaks and to prevent or contain possible well blowouts. Any of these mishaps would effect the environment and associated fish and wildlife resources over a very long time frame. 15-2

The opportunity to provide comments is appreciated and we look forward to working with you in the interest of the State's fish and wildlife resources and their public use.

Sincerely yours,

Charles D. Kelley
Director

RESPONSE TO COMMENTS

15-2. Contingency plans are discussed under accidents and spills sections of the GEIS and chapter 5 of Appendix E. It is beyond the scope of the GEIS to develop a detailed contingency plan.

Form 16

OIL AND GAS BOARD OF ALABAMA

ERNEST A. MANCINI

1984

... 1984, the comments of the State ... of Alabama regarding the document "Exploration ... Hydrocarbon Resources in Coastal Alabama and Mississippi" ... Impact Statement) are listed below:

... Injection--"Alabama statewide has approximately ... had approximately 120 enhanced recovery wells. 16-1

... wells by definition include enhanced recovery wells ... the title of the map should be "disposal wells." 16-2

... In 1983 it was again raised to 10 percent

... the tax is measured at a rate of 10 percent except for wells producing 25 barrels or less of oil per day or 200,000 cubic feet ... per day which is taxed at 6 percent. For offshore production ... production at depths greater than 18,000 feet below ... level, the tax is 8 percent. In this discussion the 10 percent tax for the period February 1983 ... omitted. During this time, the tax was 6 percent for wells producing 10 barrels of oil per day or less. 16-3

Figure 1-2, p. 1-3, and Figure 2-2, p. 2-4 of Executive Summary--Hatter's Pond ... listed as an oil field, but it is a gas condensate field. 16-4

... The incident concerning drilling muds discharged ... Oil.
Comment: No reference is made in regard to the State Oil and Gas Board sampling ... 16-5

RESPONSE TO COMMENTS

16-1. The text has been revised to indicate that over 100 enhanced recovery wells exist presently in Alabama. An exact number is not required for the discussion and, since it will vary with time, will not be given.

16-2. The figure has been revised to provide a more accurate descriptive title.

16-3. The text has been changed (paragraph 3.250) to reflect the May 1984 revisions to the Alabama law.

16-4. Figure 1-2 has been revised.

16-5. The text has been revised to include the Alabama Oil and Gas Board sampling.

If you have any questions regarding our comments, please contact us.

Sincerely yours,

Ernest A. Mancini
State Geologist and
Oil and Gas Supervisor

iet

LETTER 17

Mississippi State Senate
JACKSON

COMMITTEE ASSIGNMENTS:
Oil, Gas and Other Minerals, Chairman
Agriculture
Appropriations
Military Affairs
Public Utilities
Universities and Colleges

SENATOR RONALD C. SHOWS
41st District
Covington-Jefferson Davis-Jones Counties
Route 2, Box 228, Bassfield 39421

June 12, 1984

District Engineer
U.S. Army Corps of Engineers, Mobile
Post Office Box 2288
Mobile, Alabama 36628

RE: Draft generic environmental impact statement for exploration and production of hydrocarbon resources in coastal Alabama and Mississippi

Dear Sir

The State of Mississippi is vitally interested in developing its natural resources. Over the years the Legislature has passed legislation to facilitate the exploration and production of oil and gas giving equal consideration to all parties.

Naturally, we are all concerned with the preservation of the environment. However, the petroleum industry has a proven record of meeting existing standards and there is nothing to indicate this will not be case in the future. It is my belief that state, local and federal governments should not discourage the potential development of our resources in offshore waters by insisting on environmental standards that are unreasonable.

June 12, 1984
Page Two

The exploration and production industry provides revenues which contribute significantly to the financial welfare of our state and should be encouraged to drill wells and find commercial quanitites of oil and gas without undue restrictions.

Expediting the permitting process in an orderly and reasonable manner is an important step in that direction. I urge the Mobile District to follow through with publication of a final general permit that will be acceptable to all interested parties. 17-1

Sincerely yours,

Ronald C. Shows

RCS/afg

RESPONSE TO COMMENTS

17-1. The Mobile District has considered the comments received on the draft General Permit in preparing the proposed final General Permit.

LETTER 18

THE MOBILE BAY AUDUBON SOCIETY

BOX 9903
MOBILE, ALABAMA 36689

June 14, 1984

Recommendations on Executive Summary-Exploration and Production of Hydrocarbon Resources in Coastal Ala. and Miss.-Draft Generic Environmental Impact Statement (DGEIS)

In reading the Executive Summary and glancing at the bulky DGEIS it appeared apparent the process was not properly co-ordinated, somewhat misleading and inconsistent. | 18-1

Exec. Summary-2-I--2.I--"--oil in formations underlying the Mobile Delta--"

GEIS-Chap.I-I.4--"In 1982, oil and gas were discovered in a deep formation in the Delta--"

Exec. Summary (E.S.)- 2,3--" no fields are yet established in southern Mobile County, two recent wells have been drilled successfully to these same shallow formations--" | 18-2

21,000' is not shallow

Pg. 2-5--2.7--"The Corps must assess the environmental effects--"
It should be recognized that a co-ordinating process exists including EPA, F&W, NMF, etc. to determine decision of a permit | 18-3

"--several sources"helping in this permitting process are identified-- others need added--
Executive Order II990-dealing with wetlands and requiring all alternatives be considered | 18-4

Executive Order II988- dealing with flood-plain which also requires all alternatives to be considered

Pg. 2-7--2.8--According to NEPA-all alternatives must be included in discussion process and in reports in order to provide every protection for natural resources and better decisions. This would provide alternatives to a proposed project that could be better qualified in protecting the environment and possibly be more economically acceptable. This does not appear to be the approach of the permitting process at this stage of the game. In the past it was included and there wereless arguments in many of the proposed projects. | 18-5

Pg. 2-7-2.9--"significant cumulative effect on the human environment--- natural environment should be added. | 18-6

RESPONSE TO COMMENTS

18-1. The text has been revised to reflect this comment.

18-2. The sentence referred to in the comment describes wells drilled for shallow gas deposits (generally less than 3000 feet) and not the Smackover-Norphlet Formation of about 21,000 feet.

18-3. Corps of Engineers permit actions are based upon a "public interest" decision which includes consideration of comments from agencies which you have listed.

18-4. The rules and regulations listed in paragraph 2.7 include consideration of Executive Orders 11990 and 11988 as well as other pertinent Executive Orders and Federal Statutes.

18-5. Paragraph 2.8 refers to administrative options regarding the disposition of permit applications. These options include either grant a permit as requested, grant a permit with restrictions or conditions, or deny a permit. Implementation of any of these options must be supported by the appropriate NEPA documentation. This has always been our approach since implementation of NEPA.

18-6. The human environment in the sense of the National Environmental Policy Act includes the natural environment.

[illegible] handling [illegible]--" disposal [illegible] 18-7

[illegible] environment 18-8

[illegible] resource [illegible] imported to [illegible] recent years." This is ques[illegible] off Louisiana coast [illegible] reports was in [illegible] deleting or updating with sub-[illegible] 18-9

[illegible]ons--
Seismic [illegible] surveys, require companies col-[illegible] to used data collected in past [illegible] ected and put into reports and sell [illegible] companies requesting the information. [illegible] seismic operations has caused serious [illegible] Sound area causing [illegible] c.
[illegible] believe the suspect past [illegible] could be the causative result [illegible] from "unexplained origin". The use of dynamite and compressed air has in the past caused [illegible] The commercial and sport fishermen are recognizing something is causing changes in the migratory patterns of certain fishes and shrimp re-[illegible] smaller or no catches. Again they are [illegible] "seismic operations." 18-10

Throughout the ES "joint ventures" are suggested [illegible] petroleum operations. A requirement placed on seismic operations requiring compiling data and in turn selling this data without going out in the field to duplicate the destructive and destructive operations would be more acceptable. 18-11

Drilling [illegible]
"[illegible] drilling from uplands"--- add from adjacent river banks from vessels (Delta)
"[illegible] drilling from uplands"-add and other [illegible] drilled rig sites 18-12

Production Phase
require co-ordinated, co-operative "joint ventures"
Identify site locations suitable for them to consider with public input
[illegible] number of facilities 18-13

Abandonment Phase
Leave door open for consideration of removal of pipelines 18-14

Pg.3-4--3.7-"Discharge will be allowed of uncontaminated rainwater." This should not be allowed-see attached.
Rainwater hitting drilling rigs becomes contaminated [illegible] comes in contact with petroleum fractions [illegible] sources of heavy metals such as barium, [illegible], chromium, copper, lead, mercury, stron-[illegible] and zinc. 18-15

RESPONSE TO COMMENTS

18-7. The text has been revised to mention the need to dispose of waste products.

18-8. See response to comment 18-6.

18-9. The text has been revised to indicate that there has been public concern over the extent to which the U.S. could become dependent on foreign sources of hydrocarbons.

18-10. In accordance with Rules and Regulations of the Corps of Engineers permitting program appearing in the Federal Register 22 July 1982, seismic exploratory operations are permitted under a Corps of Engineers Nationwide permit. The Corps of Engineers has no other regulatory responsibility related to the specified seismic operations.

18-11. The Corps of Engineers cannot require joint ventures. Also see response to comment 18-10.

18-12. Drilling at a river channel location with an inland barge is considered in the EIS. Use of an already existing upland drilling site would be included by implication in the upland drilling alternative.

18-13. Requiring joint ventures is beyond the scope of the GEIS and the Corps of Engineers jurisdictional authority. However, minimum disturbance of sensitive resources is addressed by the GEIS and will be a major consideration in Corps of Engineers permit actions.

18-14. The GEIS discussions assume the pipelines after being cleaned and flushed would remain in place. However, this is not a requirement of the Corps of Engineers.

18-15. Potentially contaminated rainwater must be collected and disposed of with other wastes. Only uncontaminated rainwater can currently be discharged.

3

[illegible] to a recent National Academy of Science report-[illegible] enclosed copies of some of the pages-[illegible] behavioral modifications, have been reported following [illegible] exposure to petroleum concentrations in the low (parts per billion)--" (Drilling Discharges in Marine Env.) — 18-15 cont.

Pg.[illegible]-3.7-"All canals and slips--will be restored--" [illegible] is just in the experimental stage and should be recognized as such. It is possibly the right way to go, but as [illegible] has not proven successful. — 18-16

Slant drilling should be required to prevent dontinued dredging of canals and slips. We're destroying and modifying the delta and possibly the estuarine system. — 18-17

Instead of dredging canal slips, board roads would be preferable-removing as soon as possible. — 18-18

[illegible] site should be con-[illegible] costs and impacts must be considered instead of the costs to the petroleum company as appears to be the case in point. — 18-19

"--some joint ventures will be used for pipelines," This should be required for drilling(production) and production facilities. — 18-20

Pg.3-7 Figure 3-4-suggest footage be added — 18-21

Pg.3-I53-Figure 3-I4--Not deliniated as wetlands or sensitive areas --Little Point Clear-wetlands
Galliard Island-Bird habitat
Gulf beaches-sensitive ecological systems — 18-22

Suggest oiled bird response team and equipment be on hand & be set up using local people. Need to update previous team [illegible] areas. Need to identify habdling sites, identify citizens and prepare them, need local veterinarians, financial responsibility identified. — 18-23

Pg.3-I5[illegible]-Figure 3-I5--Map appears incomplete-What about north and middle Mobile Bay and Gulf coast off Ft. Morgan Peninsula? — 18-24

Pg.3-I57-Figure 3-I8--Baldwin County appears neglected. There have been mud handling facilities, supply boats sites according to news articles. — 18-25

Pg.3-I59-Figure 3-I9--Major channel to Bayou La Batre?? — 18-26

Pg. [illegible]-Figure 3-2I-Need to add National Areas.
First of all Mobile Bay should be at the top of the list.
Skunk Bayou has been acquired-first for BSNWP, but is planned to be a part of Weeks Bay Estuarine Marine System(proposed)
Dauphin Island "Bird" Sanctuary
Battleship Park-State's major tourist attraction. A [illegible] historical boardwalk is now in place. Pinto Pass now a "prime wetland" and once a major port [illegible] was protected during the [illegible] war [illegible] Battery McIntosh and Battery Gladden and the Battle- — 18-27

RESPONSE TO COMMENTS

18-16. The potential recovery of refilled canals and slips is discussed in the EIS.

18-17. Comment noted. The potential for the use of directional drilling as an alternative to canals and slips is considered in the EIS.

18-18. Comment noted. The potential for the use of board roads for well site access is considered in the EIS.

18-19. The use of air-transportable drilling rigs in the Delta is probably not possible because of the depth of the potential resource zone. The text has been revised to remove reference to air-transportable rigs.

18-20. See response to comment 18-13.

18-21. A generalized stratigraphic column gives the age and sequence of formations in an area. The depths to each formation would vary within the study region.

18-22. As noted on the figure, locations shown are diagrammatic only. Not all wetland areas can be shown at this scale. Gaillard Island bird colony has been added.

18-23. Comment noted.

18-24. A note has been added to the figure indicating that no data are available for blank areas from the cited reference.

18-25. The facilities referred to in the comment have only been proposals.

18-26. The figure legend has been revised to indicate that federally-maintained channels are shown.

18-27. Due to the scale of the map only the major additions have been depicted. These are Mobile Bay, Dauphin Island Bird Sanctuary, Battleship Memorial Park, and the Nature Conservancy property.

Sh... Commission constructed the "boardwalk" to educate ... these vital natural-historical features of the area.
Nature Conservancy acquired 20,000 acres in the southern portion of the delta-They need identifying.
Gailliard's Island not identified-It is utilized as a recreational, birding site. It is also utilized as an educational, interpretative, research area. 18-27 cont.

Pg.2-7-Table 2-3--overwhelms the reader-one thing noted -there should continue to be the same measurements noted on similar graphs.
Emissions is noted as tons on this Table, but not on Pg.2-13-Table 2-4. Tons is preferable 18-28

Pg.2-1?-Table ...-Use of proper sediment traps, booms, etc. to control erosion and turbidity, etc. must be required du... abandonment". 18-29

... should state so. 18-30

Pg.2-18-Table 2-4-... drilling wastes to "sink" or be "carried ... the sediments" is a very serious long-term impact and recognized as such. It should not be passed over as an acceptable occurence. The long-term impacts can be severe. 18-31

At the public hearing, individuals were trying to make light the impact of "turbidity". In reading the thick volume it was enlightening to read the somewhat thorough description of how serious impacts from "turbidity" could be in shallow systems, affecting in some ways the total ecosystem. I haven't finished the large Draft, but will eventually.
Another individual tried to make the point that long-term impacts had not been identified in the exploratory drilling in Mobile Bay. The reasons are there is not a proper monitoring program in order for proper assessment. There are serious concerns regarding the smaller catches of fish, shellfish, etc. within our bay system and commercial fishermen and others are wondering if the "general permitted" seismic operations that have occurred ... continue to occur have possibly caused migration pattern changes and possibly caused the unexplained catfish kill.??? 18-32

Table 2-6-is too limited. Chemicals should be expanded to identify the heavy and toxic metals, bacteracides, etc. 18-33

Pg.2-19-Table 2-7--"excess rutting" could cause dewatering of wetland areas, casue possible salt water intrusion, erc. 18-34

Noise-dynamite and compressed air can be loud 18-35

Navigation-is the survey cable-one or two miles long?? Pg. 2-31 mentions 2 miles 18-36

Pg. 2-21-Table 2-...-air emissions--hydrogen sulfide?? 18-37

Pg. 2-...-Table 2-9--...discussing resuspension, especially in Mobile Bay-heavy metals, toxic components, fecal coliform ... re-rel... 18-38

RESPONSE TO COMMENTS

18-28. Emissions in Table 2-2 have been changed to tons per year (TPY) to match other summary tables.

18-29. Comment noted. The need for erosion and turbidity control will be taken into consideration on future permit actions.

18-30. See response to comment 18-16.

18-31. The effects of a drilling waste spill are discussed in the EIS.

18-32. Comment noted.

18-34. The effect of seismic surveys in wetlands is discussed in the EIS.

18-36. The longer cable would be used in the Gulf of Mexico. Shorter cables may be used in Mobile Bay and Mississippi Sound.

18-37. The impacts of H_2S are summarized in Tables 2-6, 2-11, and 2-16.

18-38. Comment noted. These are summary tables. Refer to the text for further discussion.

[illegible] and also refilled"- should be rec- [illegible] | 18-39

[illegible] and [illegible] must be considered [illegible] drilling the other | 18-40

Pg. [illegible] should be rewritten. The large DEIS [illegible] something of this nature is summary [illegible] products, chemicals and hydrogen [illegible] devastating impacts and this summary [illegible] identify them. [illegible] king wont solve the pro- [illegible] long-term impact. | 18-41

Throughout [illegible] summary and the thick volume, the language [illegible] that Alabama's law requires a "no dump". [illegible] volumes. | 18-42

[illegible] allowed to state | 18-43

[illegible] ation--". It was good [illegible] in any phase of [illegible] need to be made aware-if they [illegible] | 18-44

[illegible] the chemical makeup of "fracturing chemicals [illegible], etc. | 18-45

[illegible] noted-Weeks Bay is being consider- [illegible] marine estuarine sanctuary. [illegible] identify potential sites for production facilities. | 18-46

Pg.2-52-Table [illegible]-Discussion of state of the art refinery pro- cesses promoting closed systems should be of interest. | 18-47

[illegible]-Table 10-1- Water Quality-designate certain areas that [illegible] every protection and no permits allowed in close proximity [illegible] area | 18-48

Aquatic ecosystems-Does "Spill contingency plans include hydrogen sulfide releases"? | 18-49

"Environmental review of permit applications by federal and state agencies." Public review should be part of the process. | 18-50

Pg. [illegible] & 9-Table 10-1-has some good ideas-let's hope they are required. There needs to be more encouragement to better pre-treat, reuse-then underground injection. This is a poten- tial time-[illegible] for future generations, | 18-51

a mitigation measure could be a land bank. Acquisition of lands or donations of lands for public use or preservation. | 18-52

Pg.13-2-13-4-"An important purpose of this GEIS is to ex- pedite the permitting process--".

As mentioned through PN No.MDCC2-Public Hearing No.PH84-1002- L--Proposed General Permit for Hydrocarbon Exploratory/App- raisal Drilling Activities in Mobile Bay, Ms. Sound, And Al/ Miss [illegible] Waters, [illegible] Society is outright opposed to the granting of "general permits" of this nature. | 18-53

RESPONSE TO COMMENTS

18-39. See response to comment 18-16.

18-40. These alternatives are discussed in the EIS.

16-41. The table as presented is considered an adequate summary.

18-42. The current zero-discharge requirement is an assumption of the EIS analysis.

18-43. See response to comment 23-10.

18-44. Comment noted.

18-45. General references to these compounds are contained throughout the text. However, they vary so much from site to site, it is difficult to be specific in a generic study.

18-46. Figure 3-21 has been revised to include Weeks Bay as being considered for National Estuarine Sanctuary Status. The likely location of production facilities is presented in Chapter 8 paragraph 8.336.

18-47. Table 10-1 includes several references to state-of-the-art emissions control systems. Please note that "refineries" are not part of this study.

18-48. See first sentence of third column, "Prohibit hydrocarbon..."

18-49. Emergency plans relating to the release of H_2S are a requirement of the State oil and gas boards. They are generally referred to as Hydrogen Sulfide Contingency Plans. See page 10-11.

18-50. "Public review" has been added to the table since that is a requirement of the regulatory process.

18-51. Comment noted.

18-52. The Table has been modified to indicate that acquisition of lands for preservation is a potential mitigating measure.

18-53. The Audubon Society's position on the proposed General Permit is noted and will be taken into consideration as to whether or not to issue the General Permit.

6

The public wants to be aware, informed and kept abreast of the upcoming requests for individual permits within our state lands and waters.

In order to recognize possible serious individual and cumulative impacts we must insist that no general permit program be considered. 18-53 cont.

Distrust of state and federal agencies already is causing stronger alliances among environmental and other groups. Distrust of the oil/gas industry is also very strong. If general permits are granted then this distrust will increase and public power can be very strong and lethal in certain areas.

An area the public has not realized is the tremendous costs all of this growth will be costing each of us in the increased community infrastructures such as more roads, and maintenance; more police and fire and medical services, air and water quality impacts. Threats to our groundwater supplies. More expensive sewer treatment systems, schools, etc. Our way of life and our life support systems will be severely changed and threatened, yet the majority feel it is out of their hands. Allowing a general permit for these operations will accelerate these processes. Public input is vital and required. 18-54

A great deal of money (public money) has been spent on this GDEIS. It is hoped it will be used for the good of the public and not allowed to sit upon a shelf and gather dust. 18-55

There is a great deal of good material, especially in the thick volume and if an Interdisciplinary Task Force is made up of state, and federal agency, industry and interested citizens to use this material in a positive way then the money spent can hopefully be put to a good use. 18-56

Sincerely,

Mrs. Myrt Jones,
President

RESPONSE TO COMMENTS

18-54. The potential socioeconomic effects of hydrocarbon resource development are discussed in the EIS.

18-55. Agree; the EIS was designed to be a functional document for use in future permit actions.

18-56. Agree. The EIS should be of use to all the interests you have mentioned. As you are aware when the need arises the District asks for review, assistance, or advice from individuals representing the various interests either through the formal review process or other meetings. This has been the case with preparation of the generic EIS as discussed in Chapter 15 (Public Involvement).

LETTER 19

FOWL RIVER PROTECTIVE ASSOCIATION, INC.

P.O. BOX 1074 • THEODORE, ALABAMA 36582

June 13, 1984

US Army Corp Of Engineers
Mobile District
P. O. Box 2288
Mobile, AL 36628

ATTN: SAMOP-S

Dear Sirs

The following comments reference Public Notice No. MDG02 and the DEIS on Exploration and Production of Hydrocarbon Resources in Coastal Alabama and Mississippi and are submitted for your consideration:

1. General Comments:

(A) Information contained in the DEIS indicates that the possibility for severe damage to the environment of the Mobile Delta, the Coastal area, and Mobile Bay exists unless careful supervision and monitoring by all responsible agencies is carried out. 19-1

(B) Slant drilling should be utilized where possible to minimize the number of platforms in a given area. In the delta, it is suggested that drilling from land areas should be conducted to avoid destruction of swamp areas. 19-2

(C) Alabama's drilling regulations were developed after years of research and input from concerned agencies. These organizations wished to protect the environment and still encourage development of our resources. These regulations should be strictly enforced and constant monitoring of drilling sites should take place. 19-3

(D) Information contained in Enclosure # 1, abstracted from Proposed OCS Sale, Georges Banks, shows that drilling muds, deck drainage, cuttings, and production fluids are sources of pollution and damage the marine environment. Drilling muds contain heavy metals and may contain hydrocarbons and should not be allowed to be dumped in our waters. Deck drainage may also contain hydrocarbons and should not be dumped. Petroleum fractions, particularly polycyclic aromatic hydrocarbons are carcinogenic and mutagenic (Freudenthal and Jones, 1976). We believe that rainwater drainage from drilling platforms is contaminated by a variety of dangerous chemicals. Such rainwater should be disposed of properly and not allowed to run off into surrounding waters. 19-4

(E) Mobile County receives many millions of dollars from tourism, fishing, and boat sales and licensing, recreational fishing, duck hunting and commercial seafood sales. We cannot afford to lose this income through destruction of our area by uncontrolled oil exploration and production. Louisiana is spending millions of dollars to replace wetlands lost in this manner. 19-5

RESPONSE TO COMMENTS

19-1. Comment noted. The magnitude of environmental effects of the various hydrocarbon resource development activities described in the EIS varies, depending on the particular activity and the place that it would occur.

19-2. Comment noted. As stated in the EIS, only a very small portion of the Delta area is accessible by directional drilling from adjacent uplands.

19-3. Comment noted.

19-4. The analyses in the EIS are based on the current state policies of Alabama and Mississippi that the discharge of potentially contaminated materials is permitted.

19-5. Comment noted. The economic importance of tourism, recreational fishing, boating, hunting and commercial fishing is described in paragraphs 3.261 through 3.272.

p 2 FWPA to COE

(F) More research should be carried out to determine the effect that heavy metals have on the marine environment and what effect they have on persons consuming seafood containing heavy metals. 19-6

2. Specific Comments:

(A) Page 3-25 Para. 3.47. Data shown is for 1973 and 1977. The Theodore Industrial Area was not in existence then and has affected this area. 19-7

(B) Page 3-28 Para 3.59. Noise levels are only considered if identified during public review. They should be considered as part of the process. 19-8

(C) Page 3-29. Para 3.60. Again outdated data is utilized. Much has been added to the Theodore area since 1977, the Ideal Cement Plant for one. 19-9

(D) Page 3.39. Para. 3-79. Oil exploration will add to this pollution level. 19-10

(E) Page 3.62. Table 3-18. Data shown is from 1972. DO levels are probably different now. 19-11

(F) Page 3-65. Para. 3.146. Discharge from industrial sources in the Theodore area have not been considered. 19-12

(G) Para. 3.261-3.272. These paragraphs show the millions of dollars of income derived from tourism, water-based recreation, boat sales and licenses, recreational fishing, water fowl hunting and commercial seafood landings and sales. We can not afford to take chances with this large amount of income. 19-13

(H) Para. 4.1-4.557. Due to the sensitive nature of the Mobile Delta, the possibility for great damage to the environment exists unless all possible precautions are utilized. Damage may occur from salt water intrusion, drainage of swamp areas by canals, disruption of marine and wildlife in areas where drilling occurs and damage from spills or dumping of oil or drilling fluids. Where possible, slant drilling from land areas should be employed and strict monitoring and inspection procedures should be established and carried out. One can not depend on the oil companies to police themselves. 19-14

3. In conclusion, we believe that oil exploration can take place as long as strict conditions to protect the environment are met and that drilling sites are inspected and monitored at all times. We do not believe that the oil companies will adhere to conditions imposed unless strict monitoring is carried out. 19-15

Sincerely,

R.W. Hodge, President

Attachments and Copies to: ADEM
US Fish And Wildlife Service

RESPONSE TO COMMENTS

19-6. Comment noted.

19-7. A more recent study of the Theodore area shows the following: Theodore industrial area calculated ambient concentrations maximum annual average ($\mu gm/m^3$)

Background	1977		1992	
TSP	SO_2	TSP	SO_2	TSP
35	10	45	19	47

Source: Draft EIA-Ideal Basic Industries, Appendices Vol. II, USEPA Region IV 904/9/78-005.

The result has little or no impact on the final analysis.

19-8. Noise is an environmental issue which receives varying emphasis from state to state as stated in Paragraph 3.59. This CEIS has given considerable emphasis to noise in the environmental review process. We agree that noise should be considered together with any other relevant environmental issues in state and federal permitting actions.

19-9. The CEIS evaluations of noise included information on the Ideal Basic Industries plant at Theodore Industrial Park. The most effective way to mitigate noise [illegible] is to locate major industrial noise generators in areas dedicated for industrial use, thus avoiding incompatible noise impact to surrounding land uses.

19-10. The reviewer indicates that oil exploration will add to a pollution level which, according to the Areawide Water Quality Management Plan, will not allow fishable-swimmable waters to be attained by 1983. The discussions of water quality in the Draft EIS outline worst-case and best-case conditions in Chapter [illegible] on the various possible hydrocarbon development alternatives outlined in Chapters [illegible] 7. The magnitude of water quality impacts will vary greatly depending upon the type of development, adherence to regulations and avoidance of accidents.

19-11. Table 3-18 is a good summary of water quality information for a variety of parameters. The attendant text presents summarized data from other studies as recent as 1983. The data in Table 3-18 are representative of data given in other studies.

19-12. The objective of Chapter 3 is to describe the environment of the entire study area: delta, bay, sound and state Gulf waters. Discharges in a certain section of Mobile Bay were not considered because data have not been located by the cooperating agencies indicating to what extent bay water quality is affected by these discharges.

19-13. Comment noted.

19-14. Comment noted.

19-15. Comment noted.

Enclosure # 2

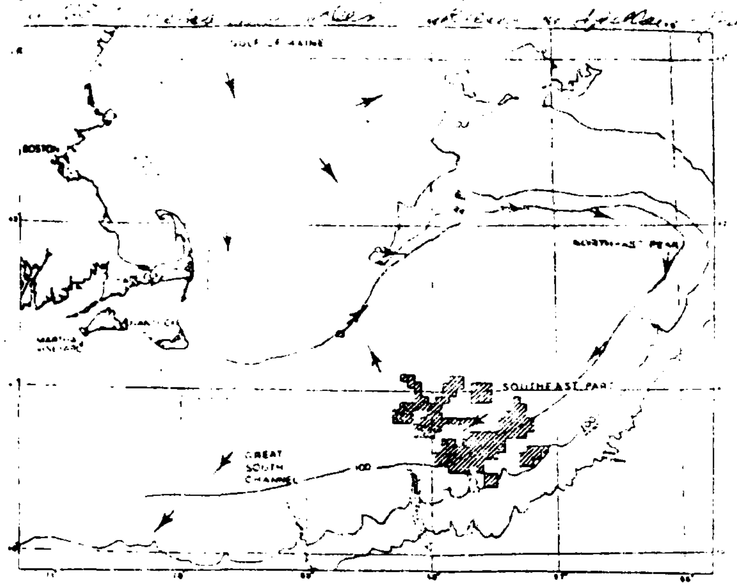


FIGURE GEORGES BANK ////PROPOSED OCS SALE 42 TRACTS —— SURFACE CURRENTS

it loosens probably serving as a mechanism for the dispersal of larvae and potentially pollutants, to the mid-Atlantic. The average nature of the current regime, though, resupplies fish and shellfish to predictable areas of the Bank. The occasional breakdown of the system explains the more isolated occurrences of different species on the Bank and to the south. Unfortunately, the hydrographic features which insure the high productivity supporting the fisheries of Georges Bank also provide a mechanism for the entrapment of pollutants resulting from normal operating procedures and oil spills during OCS exploration and development.

THREATS FROM PETROLEUM ACTIVITIES

Threats to fisheries from OCS exploration and development arise from two sources: pollutants and use conflicts. Pollutants from normal operating procedures include drilling muds, cuttings, produced waters and deck drainage. Blowouts and tanker spills provide an unpredictable but large source of hydrocarbon contamination.

Drilling muds contain a variety of potentially toxic constituents ranging from heavy metals such as chromium to biocides such as pentachlorophenol (Montalvo & McKown 1975, Robichaux 1975). Bulk discharge of muds can result in smothering of benthic fauna and clogging of gills of organisms. Discharge plumes also cause reductions in transmitted light resulting in localized decreases in photosynthesis (BLM 1977). This phenomenon affects phytoplankton populations and is potentially lethal to fish eggs and fish larvae. Further, fish in the Gulf of Mexico are attracted to releases of drilling discharges (N. Richards, pers. comm.). Grass shrimp show a similar response (Branson & Rao 1979).

Drilling muds, produced waters (brines) and deck drainage are sources of heavy metals.

These metals include barium, cadmium, chromium, copper, lead, mercury, strontium and zinc (Rittenhouse et al. 1969, Montalvo & McKown 1975). Few of the field and monitoring studies of drilling operations have examined the uptake of metals by the local fauna. One which did, the Buccaneer oil field study (NOAA 1977), showed higher levels of heavy metals in fish, shrimp, barnacles and plankton than were present in the same species from the control site. The Gulf Universities Research Consortium (Moncalvo & Brady 1975) did not find higher levels in its samples from oil rigs in Timbalier Bay, Louisiana, however, test and control localities were both in areas of petroleum production (Sanders & Jones, ms.).

Drilling discharges and deck drainage also contain hydrocarbons. Petroleum fractions, particularly polycyclic aromatic hydrocarbons, are carcinogenic and mutagenic (Freudenthal & Jones 1976). Further, fish eggs sampled from the area around the Argo Merchant oil spill had undergone a variety of mutations with effects ranging from mortality to developmental abnormalities (Longwell 1977). Lobsters exposed to hydrocarbons show alterations in behavior (Atema 1977) and a variety of physiological disruptions (Weiss & Sprague 1976, Forns 1977).

Exposure to toxic discharges from OCS operations may also result in bioconcentration and food web transfer. The danger and degree of these effects for hydrocarbons remains unclear although some evidence of concentration, magnification and transfer does exist (Farrington 1977). The same situation exists for metals (Windom et al. 1977 a, b). Pentachlorophenol, however, is a dangerous and persistent pollutant (Rao 1978). Because fish and invertebrates are attracted to discharge plumes and mounds of drilling muds, their chance of exposure to hydrocarbons, metals and biocides is greatly increased and thus, the potential for biomagnification and transfer is increased, also.

deck cleaning

The dangers of drilling discharges and hydrocarbons originating from these discharges, from deck drainage and from blowouts and oil spills can be summarized as follows: 1. direct lethal toxicity, 2. sublethal effects such as disruption in behavior and physiology, 3. tainting of edible species, 4. bioconcentration and transfer of potentially carcinogenic and mutagenic polycyclic aromatic hydrocarbons and heavy metals, and 5. changes in biological habitats resulting in shifts in biological compositions. All of the above provide a potential for harm to the fishery resources. The degree to which they will in a Georges area is largely unknown. Thus, in areas of high productivity such as Georges Bank, petroleum operations must proceed with special

from here
Area

caution, and the need for development must be weighed against the value of the resource.

Use conflicts on Georges Bank fall into two categories: physical obstructions to fishing and preemption of fishing grounds. Obstructions include debris lost during drilling operations and the navigational hazards presented by rigs, platforms, pipelines, subsea completions and service vessels. Emplacement of rigs, platforms, pipelines and subsea completions and their attendant safety zones preempt fishing areas. Several studies (BLM 1976, WHOI 1976) estimate the fishing space removed due to oil and gas operations as minimal; however, when these operations take place in a limited area as is the case for Lease Sale #42 and if this area overlaps with prime fishing grounds, their probability of interference with fishing greatly increases.

Fishing methods on Georges Bank require large areas (WHOI 1976). Trawling for haddock requires a high degree of maneuverability particularly during high seas. Long lining, another method used for haddock fishing, involves a bottom tending line which may be up to thirty-five miles long. Scallop dredges often dig 10-12 inches into the bottom and so can foul rigs or be damaged by pipelines. In lobster fishing trapping lines are often a mile long with seventy to ninety traps attached.

Title IV, the Fishermen's Contingency Fund, of the OCS Lands Act Amendments of 1978, is described in the next section. Special protection of fishing operations, based on information in the FMP could forestall such losses to fishermen. This protection could range from exclusion of oil and gas operations in prime grounds to requirements for special operating procedures.

EXISTING MITIGATION MEASURES

The Department of Interior, as the federal agency with lead responsibility for OCS petroleum development, is required under the National Environmental Policy Act (NEPA) (42 USC 4321 et seq.) to consider in its decision making process prior to leasing areas of the OCS appropriate measures to mitigate the adverse environmental effects of such development (40 FR 1502.14(f), 1502.16(h)). In addition, the OCS Lands Act Amendments of 1978 require the Secretary to minimize or eliminate any conflicts between OCS oil and gas exploitation and other uses of the marine environment, including fish and shellfish recovery (43 USC 1801, 1802). As discussed above, a significant environmental impact of OCS development in Georges Bank is the potential degradation or loss of fishery habitat that could occur as a result of acute oil spills.

LETTER 20

ADDSCO INDUSTRIES, INC.

P. O. Box 190, Mobile, Alabama 36601 (205) 690-7011

June 11, 1984

Lawrence R. Green
Chief, Planning Division
Department of the Army
Mobile District
Corps of Engineers
Post Office Box 2288
Mobile, Alabama

Re Draft Environmental Impact Statement concerning exploration and production of hydro-carbon resources in coastal Alabama and Mississippi and a proposed general permit for part of the study area

Attention: Environment Resources Branch

Dear Sir:

We offer the following comments regarding the captioned document. We feel that the proposed permitting area should be reconsidered and include the regions of the Mobile River Delta which you have not included. We additionally would like to suggest that you reconsider your one-mile buffer zones in particular those with respect to other structures and the navigational fairways within the bar. It is our understanding that few, if any, of the current wells which are drilled in the lower reach of Mobile Bay would conform to the proposed permit standards. We are also concerned by the permit standards which will effectively preclude exploration in shallow depths of water. 20-1

We note that the general permit applies to exploration only, although the study conducted examines both exploration and production wells. We are somewhat perplexed by the fact that such an extensive study was made, obviously evaluating and analyzing the effects of production, and then not used. 20-2

We strongly feel that the potential economic boon presented by exploration and production of hydro-carbons in Mobile Bay, Mississippi Sound, and the Mobile River Delta ... is substantial. Certainly it goes without saying that the economy in the area would use practicable and reasonable approaches particularly when additional risks are not intractable to the extent that they may exist at all. Accordingly, we would suggest that reconsideration be given to the scope of the proposed general permit and to the standards set out in such permit. 20-3

Very truly yours,

Addsco Industries, Inc.

William J. Rey
President & Chief Executive Officer

RESPONSE TO COMMENTS

20-1. As discussed in Chapter 13 due to the ecological sensitivity of the Mobile Delta and the lack of specific data to support a finding of no significant impact, it is recommended that no General Permit be considered for hydrocarbon activities in the Mobile Delta at this time. Although your comment provides no new specific information it will be taken into consideration as part of the permit decision.

As discussed in the Final GEIS Chapter 13 there have been some revisions made to recommendations for the General Permit. The one mile spacing requirement between structures has been omitted. The proposed General Permit continues to have restrictions on exploration in shallow waters, however, this does not preclude any activities since the companies may seek an individual permit for the shallow water areas.

20-2. The proposed General Permit excludes production activities since sufficient specific details of production activities are unavailable. However, the companies still have the option to seek an individual permit and provide remaining details necessary to build upon the GEIS environmental analysis.

20-3. Comment noted. See response to comments 20-1 and 20-2.

... Dock and Shipbuilding Corporation

AREA CODE 205

... statement for exploration and pro-
... coastal Alabama and Mississippi
... for exploration and appraisal drilling

... document. We are strongly in ... production of oil and gas in the area ... Statement. We also are in ... for exploration and appraisal drilling ... strongly feel that the ... appraisal and production ... Alabama and Mississippi ... substantial.

... general overhaul of ... rigs and other items of ... production of offshore oil and ... employs 400 persons, our company has ... recent years and we ... offshore oil and gas resources in our ... of significant proportions ... 21-1

... your proposed general permit ... necessary to protect the environ- ... that conditions or limiting ... which are overly protective. ... that you reconsider such restrictions. 21-2

RESPONSE TO COMMENTS

21-1. Comment noted. No further response necessary.

21-2. As noted in Chapter 13 of the Final GEIS, recommendations for the proposed General Permit have been somewhat modified. Your comments will be further considered as part of the decision as to whether or not to issue the General Permit.

United States Army
Corps of Engineers, Mobile District

June 18, 1984

We also note that the general permit applies only to exploration and appraisal drilling and not to production. We are somewhat baffled by the fact that such an extensive study has been made by the Corps of Engineers in this regard without the proposal of a production permit. We would also suggest that you reconsider this omission. 21-3

We thank you for your attention to the comments which we have set out herein.

Very truly yours,

ALABAMA DRY DOCK AND SHIPBUILDING CORPORATION

J. A. Snellman
J. A. Snellman
President

RESPONSE TO COMMENTS

21-3. As discussed in response to other similar letters of comment, the proposed General Permit excludes production activities since sufficient specific details of production activities are unavailable. However, the companies still have the option to seek an individual permit and provide remaining details necessary to build upon the GEIS environmental analysis.

AREA CODE 205

... statement for exploration ... in coastal Alabama ... for exploration

... document. We are ... and production of oil ... Environmental Impact ... general permit for ... activities. We ... presented by ... and gas in Mobile Bay, ... waters and the Mobile 22-1

... construction of offshore ... the exploration and ... 1,000 people locally ... will stimulate the ... our community.

... in your proposed ... we feel are necessary ... point out that ... present restrictions ... would suggest and request 22-2

RESPONSE TO COMMENTS

22-1. Comment noted. No further response necessary.

22-2. As noted in Chapter 13 of the Final GEIS, recommendations for the proposed General Permit have been somewhat modified. Your comments will be further considered as part of the decision as to whether or not to issue the General Permit.

[illegible]

Draft Generic
Environmental Impact Statement
[illegible] Two

We also note that the general permit [illegible] exploration and appraisal drilling and not to [illegible] somewhat baffled by the fact that such a [illegible] made by the Corps of Engineers [illegible] of a production permit. We would also [illegible] this omission.

We thank you for your attention to the [illegible] have set out herein.

Very truly yours,

ALABAMA [illegible]

William [illegible]

[illegible]

[illegible] An [illegible] permit [illegible] activities [illegible] individual permit [illegible] environmental [illegible]

Mid Continent Oil [illegible] Association
Mississippi/Alabama Division

Suite 710 First National Bank Building [illegible] Jackson, MS 39205 (601) 948-8903

James B. [illegible]
Chairman

Charles H. W[illegible]
President

[illegible] June [illegible], 1984

District [illegible]
[illegible]
Post [illegible]
[illegible], Alabama [illegible]

DRAFT GENERIC ENVIRONMENTAL
IMPACT STATEMENT FOR
EXPLORATION AND PRODUCTION
OF HYDROCARBON RESOURCES
IN COASTAL ALABAMA AND
MISSISSIPPI

Dear Sir:

In early May 1984 an [illegible] committee was formed under the Mid-Continent Oil and Gas Association (Mississippi/Alabama Division) to review and prepare [illegible] document. As a result of this effort the Mid-Continent [illegible] (Mississippi/Alabama Division) respectfully [illegible] for inclusion to the official written record the following general comments [illegible] the Draft Generic Environmental Impact Statement [illegible]. Also submitted for inclusion in the record is Attachment I [illegible] which contains specific page-by-page comments on the document. (It [illegible] that these comments [illegible] behalf of the association in no way preclude [illegible] members from submitting comments.)

1) The [illegible] comprehensive as to scope and detail of analysis, and [illegible] revisions and corrections as hereinafter recommended, it should serve [illegible] the environmental [illegible] for future permit applications in the study [illegible] analyzed [illegible] without the burden of [illegible] additional studies. Without the recommended [illegible], however, the document may not fulfill the requirements [illegible] National Environmental Policy Act (NEPA). 23-1

2) NEPA regulations [illegible] CFR 1502.14) require rigorous exploration and [illegible] evaluation of all reasonable alternatives including reasonable [illegible] jurisdiction of the lead agency. The basic [illegible] of zero discharge and site restoration preclude the consideration of [illegible] alternatives that have been routinely performed [illegible]. By failing to perform an [illegible] onsite discharge of water-based [illegible] treated deck drainage, treated 23-2

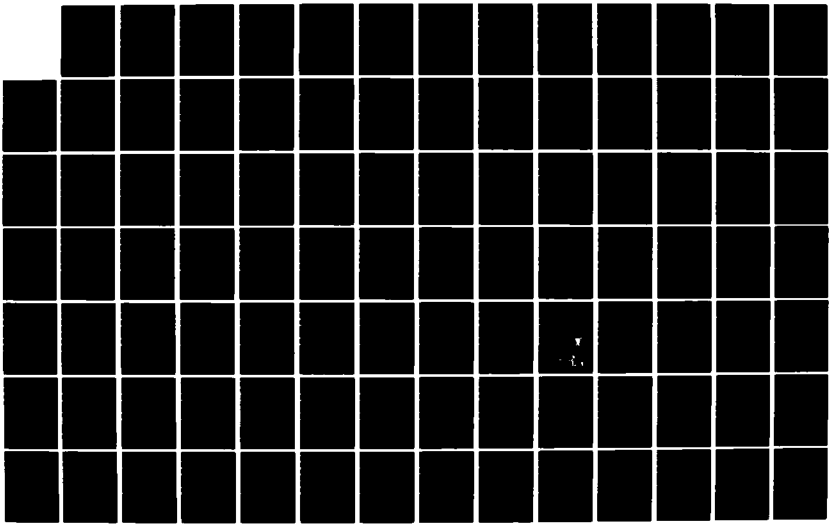
[illegible] COMMENT

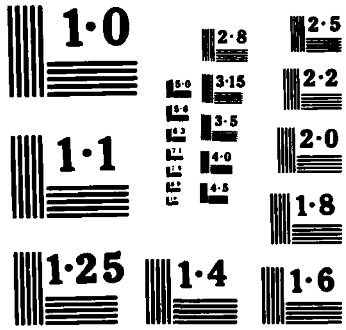
23-1. You recommended revisions contained in [illegible] have been considered [illegible] appropriate responses and revisions have been included in the [illegible] the Final GEIS is in full compliance with NEPA.

23-2. The GEIS was written based upon certain assumptions prevalent at the time [illegible] preparation. Some of these assumptions are mentioned in your comment. [illegible] are proposed outside of these assumptions, then additional environmental [illegible] could be performed depending upon the specifics of the permit [illegible].

AD-A154 316 EXPLORATION AND PRODUCTION OF HYDROCARBON RESOURCES IN COASTAL ALABAMA AND MISSISSIPPI(U) ARMY ENGINEER DISTRICT MOBILE AL NOV 84 COESAM/PD-EE-84-009 10/11

UNCLASSIFIED F/G 6/6 NL





NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

sanitary wastes and other routinely permitted discharges and the effects of natural recovery of access canals and barge slips, the GEIS is incomplete. The GEIS also fails to analyze the impacts of pipeline and platform construction and rig siting near and through grass beds, oyster reefs, spawning areas and barrier islands. While some of the alternatives noted above are not solely within the jurisdiction of the Corps of Engineers to authorize, they nevertheless are reasonable alternatives which are common practice in other areas of the United States and should be analyzed in the GEIS. 23-2 cont. 23-3 23-4

3) The important requirement of full and fair discussion of environmental impacts (40 CFR 1502.1) has not been achieved in this draft GEIS. There is a pervasive inconsistency in identifying the relative magnitude of impacts in lay terms. The consistent absence of in-depth analysis of socioeconomic impact to the states of Alabama and Mississippi from royalties and severance taxes violates the requirement for discussion of direct and indirect effects and their significance (40 CFR 1502.16). The document does not even mention benefits from receipt of lease bonus monies from future lease sales. As written the public is not presented with a fair evaluation of the very substantial direct economic effect of the analyzed activity. Nineteen pages of this document are devoted to employment analysis, but only one short paragraph and two tables are given for analysis of states' revenues from royalties and taxes. Also, escalators are assumed for employment analysis but not for oil prices and states' revenues. The projected impacts on states' budgets, funding of public service programs, effects on future rates of income taxes, property taxes, and other public taxes should be analyzed. 23-5

4) Groundwater contamination is incorrectly assumed to occur in practically every phase of operations. All tables and narrative that indicate the "certainty" of groundwater pollution should be revised to indicate only the "possibility" of groundwater pollution in the unlikely event of an accident. The assumption of groundwater pollution is not supported by paragraph 3.28 which indicates no evidence of groundwater pollution due to over 30 years of brine injection within the Citronelle Field. 23-6

5) Evidence is significantly understated that natural forces, navigational channel dredging, shrimp trawling, shell dredging and other activities produce far more turbidity and suspended solids than does dredging associated with hydrocarbon exploration and development. As presented, the reader cannot distinguish the relative magnitude of impacts and incremental increase of impacts between oil and gas activities and other activities such as navigation channel maintenance, shell dredging, shrimping, etc. In fact cumulative impacts are not even stated. Chapter 9 is merely a listing of other activities that may occur concurrently with oil and gas activities. 23-7 23-8

6) In the discussion of abandonment impacts in the Mobile Delta, Mobile Bay, Mississippi Sound, and near offshore areas, no mention is made of the restoration of sites and environmental values. Wetland loss should not be considered permanent and irretrievable. 23-9

RESPONSE TO COMMENTS

23-3. The effects of drilling sites and other oil and gas related activities in shallow water areas are discussed in the draft EIS. Some additional analyses have been included in the final EIS based on comments received on the draft EIS (see response to comments on letter 26a). Because this document is a general EIS prepared under the EIS tiering concept encouraged by the Council on Environmental Quality, all possible site-specific considerations are not discussed, but would be considered when a specific proposal is submitted for a specific area (see response to comment 23a-251).

23-4. See responses to comments 23-2 and 23-3.

23-5. The text has been revised to reflect this comment. See responses to comments 23a-129, 23a-138, 23a-179, 23a-183, 23a 185, 23a-186, 23a-196, 23a-198, 23a-203, 23a-205, 23a-206, 23a-208, 23a-209, 23a-283.

23-6. The text has been revised to indicate the possibility of ground water impacts. The summary tables have been titled "potential" as originally titled in Appendix [illegible] and various sections of the narrative have been edited.

23-7. During EIS preparation, the preparers searched for documentation of water quality impacts due to natural forces, channel dredging, shrimp trawling [illegible] in study area coastal waters not related to hydrocarbon development. All of the information available to the preparers is included in [illegible] paragraph 5.41) and in Chapter 8 beginning with paragraph [illegible]. Regrettably, available information does not allow quantitative comparisons [illegible] the various coastal water activities. However, even if impacts of dredging for hydrocarbon development appear to be small compared to [illegible] activities, adverse impacts could be important site-specifically.

23-8. See response to comment 23a-286.

23-9. The text has been revised to address better the restoration of sites. Site restoration, particularly wetlands, is recognized as a worthwhile effort [illegible] for the restoration of environmental values. The definition of what [illegible] long-term and short-term wetland loss is quite subjective. This [illegible] considers it a long-term [illegible] because the natural benefits which would have accrued from the destroyed wetland are irretrievably lost for many years. We recognize that some benefits can begin within several years after restoration with proper management.

7) With respect to normal marine vessel activities the document incorrectly states in several sections that sanitary wastes, bilge water, ballast water and other wastewaters from seismic boats and support vessels are collected and hauled to treatment plants for disposal. In accordance with existing U. S. Coast Guard regulations, as provided for by the Clean Water Act, these wastes are treated as required and discharged overboard. 23-10

8) In several instances, particularly with respect to those sections addressing noise impacts, air quality impacts and groundwater impacts, the length and detail of discussion is clearly out of proportion to the significance of the impacts. Even with grossly exaggerated assumptions on activity levels, noise and air quality impacts are very minor. Likewise even with the unsupported assumption of the certainty of accidents, impacts to groundwater are very minor. This trend of overstating insignificant impacts is consistent throughout the document and is contrary to NEPA regulations 40 CFR 1502.2(a)(b) (This trend is more fully documented by the detailed comments attached hereto). The result is a noticeable bias against the activity analyzed and a needlessly long, unfocused document. It is strongly urged that the document be revised to discuss environmental impacts concisely and in a manner proportional to their significance. The result should be a document which provides full and fair discussion of significant environmental impacts (40 CFR 1502.1) and a document which is no longer than absolutely necessary (40 CFR 1502.2 (c)). 23-11

Mid Continent fully supports the effort of the Mobile District Corps of Engineers to publish a comprehensive GEIS for exploration and production of hydrocarbon resources in coastal Alabama and Mississippi. The Mobile District is urged to incorporate the comments and revisions contained in this correspondence as well as the specific comments contained in Attachment I. Mid Continent is willing to work with the Mobile District to provide a complete final document.

Very truly yours,

Charles H. Williams, Jr.

Charles H. Williams, Jr.
President

mbv28137

RESPONSE TO COMMENTS

23-10. The text has been revised to note that discharges from marine vessels are allowable in accordance with U.S. Coast Guard regulations. For vessels with toilet facilities such regulations (33 CRF Part 159) indicate that tested, certified and properly installed Type I or Type II marine sanitation devices (as allowed by the U.S. Coast Guard) must be utilized to treat vessel wastes prior to discharge.

23-11. The document was designed to provide assessment of each identified unit action. Many unit actions create similar impacts and this causes considerable duplication and greater document length. If a unit action would have an impact on air quality, groundwater, etc., these parameters were addressed regardless of the magnitude of impact. For purposes of this GEIS, it was better to have described each potential impact rather than to gloss over some or leave them out.

LETTER 23a

Mid Continent Oil & Gas Association
Mississippi Alabama Division

Suite 910 First National Bank Building P.O. Box 22895 Jackson, MS 39205 (601) 948-8903

James B. Furrh, Jr
Chairman

Charles H. Williams, Jr
President

June 14, 1984

ATTACHMENT I

SPECIFIC COMMENTS ON THE
DRAFT GENERIC ENVIRONMENTAL IMPACT STATEMENT
FOR EXPLORATION AND PRODUCTION OF HYDROCARBON RESOURCES
IN COASTAL ALABAMA AND MISSISSIPPI, APRIL 1984

SUBMITTED BY

AD HOC TECHNICAL COMMITTEE
MID-CONTINENT OIL AND GAS ASSOCIATION

Page iii, last paragraph: As one of the most significant environmental impacts, the magnitude of royalties should be stated; add oil to expected production. 23a-1

Page iv, first paragraph: Discussion of long-term adverse impacts should be modified to reflect severity of losses (e.g. minor reduction or loss....). 23a-2

Page v, first paragraph: The intent of this study, as stated, is to identify and consider the environmental effects for future permit requests. If this goal was achieved, why is it not reflected in Chapter 13 ? 23a-3

Page vi, first paragraph: Reasonable alternatives were not considered for waste disposal (e.g. in situ disposal of drilling muds and cuttings), and the use of lightweight, modular rigs and the trestle road, as presented, are not considered by experienced operators as reasonable. 23a-4

Page vii, item 4. State magnitude of royalties; add "other 23a-5

RESPONSE TO COMMENTS

23a-1. The abstract is only a brief summary of the potential effects identified in the EIS. Details are contained in the main text. Mention of severence taxes has been added to the sentence as has "oil" to expected production.

23a-2. See response to comment 23a-1.

23a-3. The District believes this goal is reflected in Chapter 13. Review of the GEIS leads to the recommendation for a General Permit for specific activities in certain parts of the study area as discussed in Chapter 13. For other activities and locations, the GEIS provides the environmental analysis foundation for further evaluations of individual permit applications, which will provide needed details of specific actions.

23a-4. NEPA requires that an EIS identify reasonable alternatives for conduct of the proposed action(s). In the course of literature reviews on drilling methods for shallow water and wetland locations, the use of modular drilling rigs on platform structures and elevated (trestle) roads to reach drilling locations was identified. Subsequent discussions with several drilling contractors and marine contractors indicated that these methods are technically feasible (and possibly cost-effective). While "lightweight" and helicopter rigs would not be adequate to reach Jurassic drilling objectives in the study area, heavier rigs transported as lighter-weight, subassembly modules could be used on suitable platform structures.

23a-5. See response 23a-1. "Other hydrocarbons" has been added to the first sentence

hydrocarbons" to first sentence.

Page viii, item 5: The use of the phrase "complete loss of wetland area" does not help the reader identify the relative magnitude of impact. What is the magnitude of the loss and resultant environmental impact ? 23a-6

Page viii, first paragraph: Misleading, in that the GEIS concludes that the effects of turbidity associated with oil/gas activities are not expected to be significant. 23a-7

Page viii, item 6: The public should have an opportunity for additional review and analysis should the resource estimates be reconsidered. 23a-8

Page viii, item 6 b.: By what evidence are modular rigs feasible for use in the Mobile Delta ? 23a-9

Page 1-1, paragraph 1.1: Explain evidence of "increased interest" in the Mobile Delta following Superior's discovery. 23a-10

Page 1-1, paragraph 1.2: If this GEIS evaluates environmental issues of exploration through production, and if the effects presented in Chapter 8 are evaluated, why does the draft general permit exclude activities required for production ? 23a-11

Page 1-2, paragraph 1.2: Describe Corps' specific authority to administer the Clean Air Act of 1977. 23a-12

Page 1-2, paragraph 1.7: As stated, the reader would expect the lead agency to render a decision, in Chapter 13, based on the evaluation of projected environmental impacts for all studied unit actions and resource development scenarios. What is the decision for unit actions not included in the draft general 23a-13

RESPONSE TO COMMENTS

23a-6. The text has been revised to indicate that the wetland area lost for the life of the well would be within the canal and slip.

23a-7. The concern expressed in the first paragraph on page viii is the effects of temporary, short-term dredging and construction on nearby oyster reefs and grassbeds. Locations of development activities in relation to sensitive environmental resources is an important consideration which the agencies have inserted into the proposed General Permit. The Draft EIS does not state the conclusion presented by Mid Continent about effects of turbidity. Such effects can vary depending upon both location and timing of construction activities.

23a-8. The resource estimates in the FEIS are the same as in the DEIS.

23a-9. See response to comments 23a-79 and 23a-98.

23a-10. The text has been revised to remove the specific reference to Superior Oil.

23a-11. The cooperating agencies on this GEIS believe that an individual review is necessary for an application to produce a field. Production includes highly variable activities and facilities as described in the GEIS and the activities could include both water-related and upland locations. Hydrocarbon gathering systems could involve varied conveyance modes and unspecified landfall locations through sensitive natural areas. These systems could easily impact similar construction projects in the area or conflict with other uses of the coastal resources. Also, production can last for many years with highly variable well workover activities that could heighten and prolong environmental concern. All of these reasons strongly suggest that individual review of hydrocarbon production is appropriate.

23a-12. The reference to the Clean Air Act has been removed.

23a-13. This is a generic EIS which presents subjective, summary conclusions on overall hydrocarbon development based on factual data and accumulated review experience. It is a cooperative interagency effort not solely that of the Lead Agency.

permit

Comment	No.	Response
Page 1-3, paragraph 1.9: Does this document identify any significant cumulative environmental effects for the activities studied ? Please describe.	23a-14	23a-14. The cumulative effects of hydrocarbon resource recovery activities are described throughout the EIS. The purpose of paragraph 1.9 is, as clearly stated, to describe events resulting in the decision that a generic environmental impact statement must be prepared.
Page [illegible] discussion of regulatory procedure: The word *FOLLOWING* [illegible] be deleted from title preceding paragraph 1.14, unless it is the intent of the Mobile District not to use the results of the GEIS to issue or deny permit requests for studied unit actions. The entire discussion (Paragraphs 1.14, 1.15, 1.16) needs clarification: The GEIS appears to be designed to satisfy NEPA requirements for a pre-project environmental investigation (paragraph 1.13), and yet paragraph 1.15 suggests a need to re-advertise for unit actions and activities already covered in this document and previously coordinated with all interested parties. Paragraph 1.16 should be deleted. This GEIS addresses all unit actions and expected activities.	23a-15	23a-15. The word "Following" has been deleted. Paragraphs 1.14, 1.15 and 1.16 were meant only to discuss the regulatory procedure that would be followed during preparation of the GEIS. Chapter 13 contains recommendations for deviation from the procedure mainly by issuance of a general permit for exploration/appraisal drilling activities in certain parts of the study area.
Page 1-5, paragraphs 1.17, 1.18: Apparent contradiction as to who prepared the document. What parts of the GEIS were prepared by each of the listed agencies in paragraph 1.17 ?	23a-16	23a-16. The text has been clarified to indicate agency responsibilities more clearly.
Page 1-[illegible], Table 1-[illegible]: The four study areas depicted are not consistent with those described in the narrative.	23a-17	23a-17. The text of paragraph 1.2 has been revised to clarify the study area.
Page 1-11, Figure 1-3: Federal lease tracts are incorrectly illustrated.	23a-18	23a-18. Figure 1-3 has been corrected to include all current federal leases.
Page 2-1, first paragraph: Lightweight rigs are not considered to be "feasible" equipment for use in the Mobile Delta.	23a-19	23a-19. See responses to comments 23a-79 and 23a-98.
Page 2-1, paragraph 2.2: Continued confusion with study areas; study areas are not the same as unit action areas.	23a-20	23a-20. See response to comment 23a-17. Paragraph 2-2 has been revised to clarify the study region and to indicate that four operating environments have been identified as a basis for the unit action analysis.

Page [illegible], Paragraph [illegible]: How were assumptions made on the timing [illegible] intensity of development over the next 30 years ? | 23a-21

Page [illegible], Table 2-1: No Action alternative is not considered. | 23a-22

Page [illegible], paragraph [illegible]: First four assumptions preclude the [illegible] of impacts due to in situ disposal and natural [illegible], rendering the document incomplete. Uncontaminated ballast water should be added to the listing of allowable discharges. | 23a-23

Page [illegible], paragraph [illegible]: Provide citation for ADEM policy on [illegible]discharge. | 23a-24

Page 2-5, Table 2-2: Throughout the GEIS, mobile source emissions (boats, trucks, marsh buggies, and helicopters) are estimated. Even though these emissions are minor, they should probably be included in an analysis of the overall impact of development in area waters in NAAQS, but they should not be included in any PSD analysis. PSD rules specifically exclude mobile sources from source impact analysis (40 CFR 51.24(k) and 51.24(b)(18)). This comment applies to the whole GEIS and should be incorporated where ever mobile source emissions are discussed. To put these numbers in perspective, the adjective " extremely minor " should be added. Emissions should also be listed in tons/year/vechicle to make them consistent with other tables in Chapter 2. | 23a-25

Page 2-5, Table 2-2: Composition of drilling fluids should be stated, instead of using term "simple compounds". Change contamination of groundwater to possible contamination, or discuss under the section dealing with accidents. Change socioeconomic concerns to socioeconomic considerations. Worst case for noise is about the same as existing ambient noise levels for continuous drilling operations; noise impacts should be insignificant. | 23a-26

Page 2-7, Table 2-3: Why was assumption made of "unlined pit" ? | 23a-27

RESPONSE TO COMMENTS

23a-21. The text has been revised to indicate that details on scenario development are available in Appendix C.

23a-22. Table 2-1 is a list of the unit actions analyzed in the study. The no action alternative would not be a unit action. Paragraph 2.1a has been added to the Final GEIS discussing the no action alternative and why it is not considered in the GEIS.

23a-23. See response to comment 23-2. The listing of discharges considered in the Generic EIS has been expanded to include uncontaminated ballast water.

23a-24. The most recent citation of ADEM's position on this matter is contained in a letter dated September 21, 1984 from ADEM to the Corps. This letter clarifies that ballast water, hydrostatic test water and desalinization unit wastewater may also be permitted from rigs.

23a-25. The text (Table 2-2) has been revised to indicate that one gram/day equals 4×10^{-4} TPY. The maximum emission rate per vehicle per day does not exceed 3 TPY. The inclusion or exclusion of this small emission is of no consequence to the overall study results. The text has also been revised to indicate that mobile sources are excluded from PSD analysis. However, it should be noted that the air quality analysis conducted for this GEIS includes a conservative estimate of total emissions and is not representative of an actual PSD evaluation, although many PSD concepts are utilized throughout the text.

23a-26. See response to comment 23-6. The term "simple compounds" is adequate for these summary tables. Other text references to the drilling muds have been revised. Socioeconomic concerns has been changed to socioeconomic characteristics. Comment on noise is noted. It is not the purpose of this section of the GEIS to state relative significance; see Chapter 13, which provides the cooperating agency perspective on impact significance.

23a-27. The text has been revised to indicate that unlined pits are not permitted by AOGB; however, lined pits can develop leaks.

AOGB requires that pits be lined with impermeable membrane. Under heading of river channel site preparation, solid waste, the statement "no dredged material produced" is not necessarily true. Site preparation along the bank of the Mobile River would almost certainly require both dredge and fill activities to provide a competent foundation. 23a-27 cont.

Page 2-9, Table 2-3: Under river channel site preparation, water quality, add: some dredging may be required. 23a-28

Page 2-9, Table 2-3: Circulation in an access canal in the Mobile Delta is certainly not "quite limited" during periods of high water .... approximately one-half of the year. As flood waters rise, flow velocities within most canals exceed velocities within the main river channel, especially in the vicinity of the required "gaps". Authorized discharges of bilge and ballast water should be indicated. 23a-29

Page 2-11, Table 2-3: Under the discussion of trestle road preparation, socioeconomics, an implication is made that local business could not participate in other alternatives. The fixed platform category is missing from this table. Socioeconomic "concerns" should be changed to "considerations". 23a-30

Page 2-13, Table 2-4: Assumption of groundwater contamination should be changed to possible contamination, or treated as an accident. The assertion that the water quality in any canal is less favorable than that in the river channel should be documented. If the statement is true for low-water conditions, would it still be true during periods of high water (approximately half the year)? Cite empirical data from canals in the Mobile Delta to support the conclusion. The authorized discharge of bilge and ballast waters should be noted here. 23a-31

Page 2-15, Table 2-4: Failure to state that solid wastes are contained for approved, remote disposal, therefore, no impact. State rationale for assumption of improper plugging of well; otherwise delete or treat as accident. State magnitude of royalties, taxes, to be consistent with the dollar values stated 23a-32

RESPONSE [illegible]

23a-28. The text has been revised to include [illegible]

23a-29. The EIS preparers based information [illegible] information from canals in various locations [illegible] preparers indicates water velocities [illegible] circulation near the gaps would be greater [illegible] more than 30 to 50 feet from the gaps [illegible] been revised to include the authorized [illegible]

23a-30. The other summary paragraphs [illegible] thus the implication identified in the comment [illegible] category is included as columns 9 and [illegible]

23a-31. See response to comment 23-6. The USEPA [illegible] coastal canals (USEPA, 1975c) and freshwater [illegible] measurements of various water quality param[illegible] and canal depth. Given the large expanse [illegible] noted in the response to comment 23a-29, [illegible] that water quality [illegible] tions would be less favorable [illegible] has been revised to indicate the authorized [illegible] See response to comment 23-10.

23a-32. This table presents the potential environmental [illegible] not mitigation and resulting impacts (or lack of [illegible]) was described by both state oil and gas board [illegible] potentially causing problems in the future. [illegible] have a good track record of utilizing modern [illegible] dollar values have been added to Table 2-[illegible].

for other resources.

Page 2-17, Table 2-5: Under wellsites, solid waste, the terms "impact minimal" are stated, underscoring the serious inconsistency in identifying the relative magnitude of other impacts presented in the tables of Chapter 2. The importance of these tables is obvious by their inclusion in the *Executive Summary* ... many readers may direct their attention only to the tables in the main document, or to those in the Summary. Incomplete, inconsistent information presented in the tables, therefore, encourages a misunderstanding of the environmental analyses. 23a-33

Page 2-18, Table 2-6: The statement concerning hydrogen sulfide is in error; 0.1 ppm should be changed to 10.0 ppm (see page 4-86, paragraph 4.314). A spill of drilling muds in an access canal would be buried with restoration, according to this table; is the impact of this action desirable, or undesirable ? 23a-34

Page 2-18, Table 2-6: The GEIS specifies 4.9 million dollars spent in the Delta by area fisherman, but consistently omits the dollar value of royalties and taxes to be paid to the people of Alabama and Mississippi. 23a-35

Page 2-19, Table 2-7: The actual composition of drilling fluids should be stated instead of using the terms "simple compounds". The certainty of groundwater contamination from shotholes should be changed to the possibility of contamination, or this discussion should be moved to section dealing with accidents. 23a-36

Page 2-19, Table 2-7: Incorrect statement concerning the disposal of treated wastewater. U.S.C.G. approves of certain discharges of treated wastes. 23a-37

Page 2-19, Table 2-7: Continued inconsistency in identifying the magnitude and relative magnitudes of environmental impacts. For example, projected values are presented for noise and air emissions, but no mention is made of the effects of these levels. 23a-38

RESPONSE TO COMMENTS

23a-33. The purpose of this table is to state impacts as accurately as possible. Often impacts cannot be stated quantitatively and a qualitative, subjective measure may be assigned. When a subjective measure is used in the text it is chosen carefully. Those impacts which are not discernible are still shown as such.

23a-34. The text has been revised to change the safe concentration of H_2S from 0.1 to 10.0 ppm. Depending on the toxicity of the mud involved, clean-up may be preferable to cover-up.

23a-35. The referenced Table 2-6 is a summary of effects from materials spills or accidental release of H_2S. Mention of royalties or severence taxes does not belong in this table, but is discussed elsewhere in the EIS.

23a-36. The text has been revised to expand the term "simple compounds". See response to comment 23a-26. See response to comment 23-6.

23a-37. The text has been revised to note that the U.S. Coast Guard can approve disposal of treated wastewaters from marine vessels, not including drilling platforms (see response to comment 23-10).

23a-38. See response to comment 23a-33. The Unit Action Analysis was intended to describe quantitative impacts from a singular activity where such quantitative data were available. Qualitative descriptions of impacts were presented where quantitative data were not available.

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RESPONSES

Are the projected levels significant ? How do they compare with ambient levels ? 23a-38 cont.

Page 2-21, Table 2-8: Why is groundwater contamination assumed ? Change to possibility of contamination, or treat as an accident. Authorized discharge of bilge and ballast water should be added. 23a-39

Page 2-21, Table 2-8: Here, as in practically all other tables, air emissions and noise are given projected numerical value but impacts are unstated. 23a-40

Page 2-23, Table 2-8: Under routine operations, the volume of solid waste is stated, but not the impact. 23a-41

Page 2-25, Table 2-9: Groundwater contamination is assumed; treat as accident, or change to "possible contamination". Incorrect statement concerning the disposal of wastewaters. U.S.C.G approves of certain discharges of treated wastewater. Also, Alabama agencies have approved the discharge of ballast water in o area waters. All tables should be corrected to reflect the actual disposal of bilge water, treated wastewater and ballast water. 23a-42

Page 2-27, Table 2-9: Impacts not stated for noise and air emissions. Incorrect implication that severance taxes will benefit only governments. What are the projected impacts on future rates of income and property taxes, other taxes, and public service programs ? 23a-43

Page 2-27, Table 2-9: Statement concerning the volume of drilling wastes does not acknowledge remote disposal in approved sites (zero-discharge). 23a-44

Page 2-29, Table 2-10: Improper plugging assumed. Treat as accident, or describe "possible contamination". Air and noise impacts not stated. 23a 45

23a-39. See response to comments 23-4 ...

23a-40. See responses to comments ...

23a-41. See responses to comments 23a- ...

23a-42. See response to comments 23-6 and ...

23a-43. See response to comments 23a-35 and ... royalties have been added. ... in Chapter 8, not Chapters 4 through 7, ... to comment 23a-283.

23a-44. The text has been revised to include ...

23a-45. See response to comment 23-... See ...

Page 2-30, Table 2-11: Safe concentration of hydrogen sulfide is in error...0.1 ppm should be 10 ppm. Continued incorrect statement concerning the disposal of wastewaters. | 23a-46

Page 2-30, Table 2-11: Continued inconsistency is the presentation of environmental impacts. Impacts of accidents generally are stated. Why are impacts for less severe events generally not stated? | 23a-47

Page 2-30, Table 2-11: Dollar values are stated for the tourism industry, but are consistently unstated for royalties and taxes in nearly all tables. | 23a-48

Page 2-31, Table 2-12: Impacts for air emission are not stated. Boats do not discharge to sewer systems. | 23a-49

Page 2-32, Table 2-13: The loss of habitat under jackup and submersible rigs should be identified as temporary. Correct statement dealing with the discharge of bilge and ballast waters. | 23a-50

Page 2-33, Table 2-13: Cite data that would support "up to 12 people needed to bore soil". Groundwater pollution is assumed; treat as accident, or state possibility of contamination. Air impacts are not stated. Approved, remote disposal of drilling wastes not stated. | 23a-51

Page 2-34, Table 2-14. Incorrect statement about the discharge of bilge and ballast waters. | 23a-52

Page 2-35, Table 2-14: Aquifer contamination by drilling fluids assumed. Treat as accident, or indicate possibility of contamination. No mention of approved disposal of drilling wastes. | 23a-53

Page 2-36, Table 2-14: State dollar value of taxes and | 23a-54

RESPONSE TO COMMENTS

23a-46. The text has been revised to change the safe concentration of H_2S from 0.1 ppm to 10 ppm. See response to comment 23-10.

23a-47. Presentation of effects is considered adequate.

23a-48. See response to comment 23a-35.

23a-49. See response to comments 23a-33 and 23a-38. See response to comment 23-10.

23a-50. Table 2-13 has been revised to reflect the comments.

23a-51. Reference is cited in paragraph 5.34. A summary table does not include references which are found in the text. See response to comment 23-6. See response to comments 23a-33 and 23a-38. The text (Table 2-13) has been revised to include the possible disposal of dredge material at an approved site.

23a-52. See response to comment 23-10.

23a-53. See response to comments 23-6 and 23a-44.

23a-54. Unit values of severence taxes and royalties have been added to Table 2-14.

... negative impact of shell pads is ... that the positive impact of shell pads ... systems. 23a-55

... improper plugging of well is assumed. ... the possibility of contamination. Air ... not stated. ... ultimate disposal of ... 23a-56

Page ..., Table ...: Continued bias in the statement of dollar value ... versus the nonstatement of royalties and ... economic loss is unlikely, not likely. 23a-57

Page 2-..., Table 2-...: In the discussion of groundwater, accidents and contamination are presented as inevitable impacts. Change discussion to indicate potential for contamination, or treat ... accident. Air impacts are unstated. 23a-58

Page ..., Table 2-...: Groundwater contamination assumed. Treat as accident, or indicate possibility of contamination. 23a-59

Page ..., Table 2-18: Quantify royalties, taxes. 23a-60

Page ..., Table 2-19: Groundwater pollution assumed. Describe ... contamination, or evaluate as an accident. Air impacts are not stated. 23a-61

Pages ..., Table ...: The summary of environmental impacts for each ... indicates that all projected impacts from construction and routine operations will be minor to insignificant ... certain areas of the Delta and open waters ... "of concern" for certain types of activities. 23a-62

RESPONSE TO COMMENTS

23a-55. Table 2-... has been revised to reflect this comment.

23a-56. See response to comment 23-6. See response to comments 23a-33 and 23a-38. The text has been revised to mention the ultimate disposal of construction wastes.

23a-57. See response to comment 23a-35. The text has been revised to indicate that economic losses would be likely if a spill or accident occurred.

23a-58. See response to comment 23-6. See response to comments 23a-33 and 23a-38.

23a-59. See response to comment 23-6.

23a-60. Unit values for severence taxes and royalties have been added to Table 2-18.

23a-61. See response to comment 23-6. See response to comments 23a-33 and 23a-38.

23a-62. Table 2-20 has been revised to remove the words "of concern". See also response to comment 23a-251.

RESPONSE TO COMMENTS

[illegible] See last paragraph on page 2-51. See response to comment 23-6. The data supporting the 24,000 employment figure is cited in Chapter [illegible] and Appendix [illegible]. However, Table [illegible] has been revised to itemize how many jobs have the potential to involve local [illegible] and how many offer little if any opportunity for local labor.

[illegible] See response to comment 23-6. The text has been revised to complete the fourth sentence. The regulatory authority for Class I wells is not addressed here.

[illegible] The text has been revised to better define Class II wells.

23a-66 The [illegible]atory status of Class I and Class IV wells is correct as stated. ADEM is not [illegible]mitting any new disposal wells.

[illegible] See response to comment 23-6.

[illegible] See response to comments 23a-33 and 23a-[illegible].

[illegible] Turbidity is an optical measurement of light being scattered and absorbed rather than [illegible] transmitted in straight lines through a water sample. Turbidity and suspended solids concentrations cannot be correlated because different particulate matter suspended in water have different sizes, shapes and abilities to absorb or scatter light. Values given in paragraph 3.139 are as reported in the indicated references. The text has been revised to caution the reader that turbidities and suspended solids concentrations cannot be correlated.

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because ... vs suspended solids).

Page ... legislation has resulted in severance tax rates different from those listed here...need to update. | 23a-70

... paragraph 3.24...: Apparently contradictory ... has been lower than state as a ... | 23a-71

Page ..., Table 3-3...: Needs clarification; 660 people are shown as employed during 1980, involved in offshore drilling activity on state submerged lands. Other than Mobil's four ... the bay, significant leasing that could employ the stated numbers was not accomplished until 1981. How does the number of facilities relate to lease sales ? | 23a-72

Page ... discussion of solid and hazardous wastes: Need to update Oil and Gas Board rules and regulations. | 23a-73

Page ..., paragraph 3.24...: Identify new regulations that ... wastes must be certified as nonhazardous. | 23a-74

Page ..., paragraph 3.249: Cite evidence for stated "conflict ... space between fishing interests and oil interests. | 23a-75

Page ..., paragraph 3.27...: Should "land" value be "landed" value ? | 23a-76

Page 3-15..., Figure 3-21: Meaher State Park appears to be mislocated. | 23a-77

Page ..., paragraph ...: The terms bentonite or montmorillonite | 23a-78

RESPONSE TO COMMENTS

23a-70. The text has been revised at paragraph 3.230 to reflect the legislation enacted in May 1983 regarding the taxation of oil and gas resources in Alabama.

23a-71. The unemployment rate for the state of Alabama was higher than that for either Mobile or Baldwin counties from 1980 through 1982. In 1983 Mobile County experienced a higher rate than the state as a whole. Table 3-32 has been revised to show the state unemployment rate and updated to show the 1983 rates based on current information.

23a-72. The draft, unpublished report issued by the South Alabama Regional Planning Commission identified those facilities which are or could be related to offshore oil and gas exploration and development. The text, at paragraph 3.235, has been clarified to reflect the tentative relationship between the area business and the offshore industry.

23a-73. Information in this section was current and correct at the time of publication and ADEM has reviewed the section within the past several months. This type of information is certainly subject to change but is presented here to be representative of the conditions at the time of publication.

23a-74.

23a-75. The text of paragraph 3.249 has been revised to indicate that space conflict is a potential effect.

23a-76. The text of paragraph 3.270 has been corrected to change "land" to "landed".

23a-77. The location of Meaher State Park has been corrected on Figure 3-21.

23a-78. The text has been revised to add the terms bentonite and montmorillonite.

[illegible] that the use of "simple

[illegible] what industry evidence or standard [illegible] rigs "feasible" for safely and [illegible] in the Mobile Delta ? 23a-79

[illegible] within access canals [illegible] water [illegible] 23a-80

[illegible] first sentence ... where would [illegible] turbidity impacts during dredging [illegible] 23a-81

[illegible] Clarify how a short-term loss of wetlands with required restoration, can result in long-term [illegible] what is the relative magnitude of impact ? 23a-82

[illegible] Unclear as to how groundwater quality [illegible] 23a-83

[illegible] Emission factor for carbon monoxide is [illegible] stated value is for 4 rigs, not 1. All appropriate tables and narrative should be changed to show the correct value. 23a-84

[illegible] paragraph [illegible] Conventional construction equipment has not been used. In past operations in the Delta, for clearing [illegible] way for the access canal and slip. Chainsaw crews, working on foot, clear the R.O.W., while the barge mounted dredge [illegible] the timber to adjacent banks. 23a-85

[illegible] paragraph 4.56: The statement that dredged canals 23a-86

RESPONSE TO COMMENTS

23a-79. The text has been revised to delete the terms "lightweight" and "land". Discussion with several drilling contractors indicated that many modern drilling rigs, including modular offshore platform rigs as well as conventional land rigs, could be adapted to platform operations in wetlands.

23a-80. See response to comment 23a-29.

23a-81. Productivity of aquatic vegetation could be adversely affected adjacent to dredging operations. Impacts of dredging are stated in paragraphs 4.30 and 4.31 as being decreased light penetration in the water column and resuspension of nutrients, metals and oxygen demanding substances in bottom sediments. The text has been revised to clarify this point.

23a-82. Construction of a canal and slip results in the loss of the upper soil layers composed of plant root mat and organic soil layers which act to retard, filter and absorb surface runoff, all beneficial aspects of wetlands to water quality. Restoration of this upper layer takes many years but benefits should begin within several years (see remainder of text paragraph 4.33 for additional explanation.)

23a-83. The text has been revised to clarify the possible impact to groundwater.

23a-84. The text has been revised to indicate that the CO values are for four (4) rigs.

23a-85. Comment noted. Noise evaluation unchanged. Large tree stumps would still require heavy equipment to remove them, either barge-mounted dredge, dragline or dozer.

23a-86. The comment that canal widening due to erosion has not occurred in the Mobile River Delta is correct. However, only a small number of canals and slips have been dredged to date. Canal widening due to erosion, which has been evident in Louisiana, could occur in the study area depending upon vegetation and soil type, establishment of vegetation along the canal and slip banks, water velocities and hydrocarbon development patterns. The text has been revised accordingly.

often widen, doubling in width in five years has no factual merit for canals dredged in the Mobile Delta. Existing canals range in age from 2 to 21 years; none has widened as described.

Page 4-20, paragraph 4.59: Under the discussion of impacts of canal construction, it is stated that some marsh areas are eliminated. With the underlying assumption of total restoration, what marsh areas are "eliminated" ? 23a-87

Page 4-21, paragraph 4.63: The statement that all wetland values would be lost for the life of the project contradicts the observation quoted in paragraph 4.56 that the spoil banks will naturally revegetate within two years....because of the slopes and elevation of spoil banks in the Delta, most of the naturally recovered areas would support wetland species of vegetation. 23a-88

Page 4-22, paragraphs 4.68 and 4.69: The term "recolonization" should be changed to "colonization"...benthic organisms would not have occupied the pre-project areas. 23a-89

Page 4-24, paragraph 4.78: Casing requirements are incorrectly stated. Wells are cased from surface to TD. 23a-90

Page 4-27, Table 4-4: The chemistry of the mud shown is not typical of drilling muds used in the study region. A typical mud should be shown. 23a-91

Page 4-38, paragraph [illegible].115: The statement is made, "Not all parts of the Delta wou[illegible] be accessible by directional drilling." What are the resultant impacts and/or conclusions ? 23a-92

Page 4-41, paragraphs 4.127, 4.128: It is stated that a riverbank location would require the production of less solid waste (dredged material) and that the work would take less time than the canal/slip alternative. These conclusions may be in error, in that the bank location would likely be a natural levee 23a-93

[illegible]

23a-87. Some marsh areas are eliminated [illegible] activities at the site. The [illegible] following site abandonment, and will require many years [illegible] The text has been revised to reflect this situation.

23a-88. The text at paragraph 4.56 has been revised [illegible] that some natural revegetation can occur within 2 years. The text at paragraph 4.63 has been revised to discuss the revegetation [illegible]

23a-89. The word recolonization has been [illegible]

23a-90. The text has been revised to [illegible]

23a-91. Table 4-4 has been removed.

23a-92. The text has been revised to [illegible] would have to be used where [illegible]

23a-93. Paragraph 4.128 has been revised to [illegible] river bank location [illegible] the bank.

of significantly higher elevation than the adjacent wetlands, and therefore might require the dredging of greater volumes of sediment than would an canal/slip. For example, the elevation of the river bank adjacent to an existing canal near Mt. Vernon is approximately +11 ft. msl; elevation of the banks of the slip (approximately 2,000 feet inland) is approximately +3.5 msl. 23a-93 cont.

Page 4-43, paragraph 4.135: Strike words: "designed to contain spills." Add to end of second sentence,..."and to minimize erosion of the foundation pad." 23a-94

Page 4-44, paragraph 4.143: This section acknowledges that "some improvement dredging" may be required, but this possibility is not reflected in the summary tables (e.g. Table 2-3). 23a-95

Page 4-44, paragraph 4.144: A spill of drilling wastes would be more difficult to contain/cleanup in a river channel location, and probably should be addressed in this paragraph. 23a-96

Page 4-45, paragraph 4.146: Navigational hazard of river channel location is unrealistically minimized. A potential location on the outside of a meander could be well within the natural navigation channel. 23a-97

4-45, paragraph 4.149: Operators with drilling experience in the Mobile Delta do not consider the described "lightweight", modular rigs feasible for the following reasons: Safety - Although some manufacturers/distributors rate these small rigs to depths of 17,000-18,000 feet, all wells drilled in the Delta, to date, have employed much heavier-class rigs that are capable of drilling up to 25,000 feet. Relatively unknown subsurface pressure conditions within the Delta, and the difficulty of drilling through the alternating hard and soft strata to depths in excess of 18,000 feet would require safety factors greater than those associated with lightweight rigs. Availability - The lightweight rigs described in the GEIS were designed for relatively shallow drilling in generally remote areas of the world where proven, conventional equipment could not be used. A recent survey by the technical committee of Mid-continent Oil and Gas Association indicated that no lightweight rigs of the type 23a-98

23a-94. The text has been revised as indicated. In addition [illegible] sheeting associated with inhibiting spill migration has been noted.

23a-95. Reliable noise values for dredge equipment were not available. The values presented on the summary table represent similar types of equipment.

23a-96. Spills of drilling wastes would be more difficult to control in a river channel [illegible] in a canal or slip because water movements are not as constrained as in a canal or slip. The text has been changed to indicate this.

23a-97. The text of paragraphs 4.146 and 4.147 has been revised to [illegible] to navigation from structures moored in the river.

23a-98. The text has been revised by deleting the term "lightweight [illegible]" by helicopter". While lightweight helicopter-transportable drilling rigs [illegible] have the rated mast and hoisting capacities or horsepower [illegible] objectives in the Mobile Delta, heavier drilling [illegible] many conventional land rigs (which are modular to permit truck or barge transport), could be [illegible] suitable platform structures.

Examination of the cited cost documentation of the operation of a helicopter-transportable rig in [illegible] indicated extensive charges (approximately [illegible] for air logistical support and maintenance of living quarters at the remote [illegible] site. This type of logistical support and camps for crew would not be [illegible] domestic operations (e.g., the Mobile Delta).

Comment	No.
described are available domestically; all are committed for foreign assignment. Even if deep Jurassic objectives could be reached with lightweight rigs, years would be required to build enough rigs for domestic availability. Cost - Recent experience in the use of lightweight rigs by one operator in the jungles of Peru indicate a total rig/consummables cost of approximately $100,000 per day, compared to approximately $40,000 per day for an inland barge (detailed breakdown of costs is available on request).	23a-98 cont.
Page 4-47, paragraph 4.153: Waters within an access canal in the Delta would not move "quite slowly" during periods of high water, especially in the vicinity of "gaps".	23a-99
Page 4-48, paragraph 4.157: Amend first sentence to indicate temporary loss of wetland area.	23a-100
Page 4-48, paragraph 4.160: Discussion of wastewater disposal is in error throughout document...revise to indicate that the U.S.C.G. permits the discharge of certain treated wastewaters.	23a-101
Page 4-49, paragraph 4.165: What is the impact of "less dredge material and biomass would remain on site...." ?	23a-102
Page 4-50, paragraph 4.168: The use of lightweight rigs in the Delta is not considered to be feasible by experienced operators.	23a-103
Page 4-50, paragraph 4.172: Circulation within an access canal in the Delta would not be sluggish during high water.	23a-104
Page 4-53, paragraph 4.186: The use of lightweight, modular rigs is not considered by the industry to be feasible for use in the Mobile Delta.	23a-105
Page 4-56, paragraph 4.205: Materials needed for the proposed	23a-106

RESPONSE TO COMMENTS

23a-99. See response to comment 23a-29.

23a-100. Loss is for entire site preparation period. Text has been revised to indicate loss during site preparation.

23a-101. See response to comment [illegible]

23a-102. This implies that there would be less ground disturbing activities, i.e., less potential erosion, less loss of habitat, etc.

23a-103. See response to comment 23a-98. Text has been revised by deleting the term "lightweight" and the phrase [illegible] possibly delivered by helicopter."

23a-104. See response to comment 23a-29.

23a-105. See response to comment 23a-98. Text has been modified by deleting the terms "lightweight" and "helicopter".

23a-106. The text has been modified to include prestressed concrete on steel or concrete pilings as possible materials of construction for a trestle road. (See response to comment 23a-327.)

trestle road would not be just a function of weight, but also of elevation. This discussion should be rewritten to recognize that in certain parts of the Delta, roads would have to be elevated to 15-20 feet msl. The construction materials described in the GEIS would not be adequate to support the expected loads on such elevated roads. A significant fact that should be considered in this document is that no operator in the technical committee has used, or known to be used, a trestle road as described. Engineering feasibility therefore should be investigated before a decision on "feasibility" is reached. 23a-106 cont

Page 4-57, paragraph 2.08: "No" trip should be "one" ? 23a-107

Page 4-58, paragraph 4.211: Reference to road height is mentioned under hydrology, but elevation is apparently not considered elsewhere, especially in the discussion of materials and design. 23a-108

Page 4-58, paragraph 4.218: No mention is made as to how cuttings would be handled. 23a-109

Page 4-59, discussion of fixed platform on riverbank: The emplacement of a fixed platform on a riverbank may not require DOA authorization, and should be considered here. 23a-110

Page 4-61, paragraph 4.229: Clarify the impact a fixed platform would have on groundwater quality. 23a-111

Page 4-62, paragraph 4.235: No mention of how drilling wastes would be handled. 23a-112

Page 4-65, paragraph 4.238: No discussion of elevation requirements for a road or location, or the effect of changes in groundwater level within a ring levee related to changes in elevation of river waters. 23a-113

Page 4-65, paragraph 4.239: This discussion should acknowledge 23a-114

23a-107. The text of paragraph 4.208 has been corrected.

23a-108. Comment noted. [illegible]

23a-109. Refer to paragraph 4.84 for a discussion of cuttings.

23a-110. The text has revised in paragraph [illegible] to [illegible] Department of the Army permit would be required.

23a-111. See response to comment 23a-[illegible].

23a-112. In paragraph 4.2[illegible] the reader is referred to a previous section that discusses waste disposal.

23a-113. The text has been revised at paragraph [illegible] the levee, board road and drilling location.

23a-114. The text has been revised [illegible]

[illegible] elevate not only the road, but [illegible] 23a-114 cont.

[illegible] why would the hydrology impacts not [illegible] impacts if river access to the road is [illegible] 23a-115

[illegible] The amount of wetland disturbance [illegible] required elevation, and as such might [illegible] greater than 2/3 acre per 1000 feet. 23a-116

Page 4-[illegible], paragraph 4.[illegible]46 First sentence should be revised to indicate that board road may also require dredge/fill for necessary elevation. 23a-117

Page 4-68, paragraph 4.251: No discussion of how drilling wastes would be handled[illegible] certainly not the same as with canal/slip alternative 23a-118

Page 4-[illegible], paragraph 4.264: A cultural resources survey may not be required for some Delta exploration, and should be so noted. 23a-119

Page 4-[illegible], paragraph 4.269: Need to define "Louisiana Crude oil spill". 23a-120

Page 4-74, Table 4-10: A "source for some numbers" is given. Source(s) of other numbers should be stated. 23a-121

Page 4-[illegible], paragraph 4.275: Clarify "spill" of hydrogen sulfide, methane 23a-122

Page 4-[illegible], paragraph 4.[illegible]: Hydrogen sulfide is not a component 23a-123

RESPONSE TO COMMENTS

23a-115. River access to board roads is not postulated (see Figure 4-7). Drainage of wetlands would tend to occur only adjacent to the board road and well site. The text has been revised to include this point.

23a-116. The comment is correct in stating that wetland area disturbed would be a function of the height of the levee. The text has been revised to indicate this fact and to state that 2/3 acres per 1000 feet would be disturbed if the levee is as shown in Figure 4-8. The board road, ring levee system is not considered an alternative drilling location access method in all parts of the Delta, but rather an alternative in those areas of the Delta where the flood heights would not require a significant elevation increase for the board road and the drilling pad. In such areas, the potential disturbed acreages presented in paragraph 4.242 are reasonable estimates.

23a-117. The text has been revised to include dredging for the board road.

23a-118. The text has been revised to indicate the different mode of transportation required for the board road unit action.

23a-119. The text of paragraph 4.264 has been revised to clarify cultural resource survey requirements.

23a-120. The text has been revised to include a reference to "Louisiana crude oil spill."

23a-121. The spill movement distances without current and winds are based on a methodology and values given in U.S. Department of Transportation, 1977. Spill movement distances for the average and worst case are explained in footnotes (2) and (3) of Table 4-10.

23a-122. Hydrogen sulfide and methane would bubble into the water column and dissipate to the atmosphere as noted in paragraph 4.275. The term "spills" of hydrogen sulfide and methane has been changed to "releases".

23a-123. The text has been revised to remove H_2S from the list of drilling mud components.

[illegible] 4.346: Comment should be made on the impa[illegible] [illegible] good or bad?	23a-1[illegible]
Page [illegible] paragraph 4.3[illegible]: In the discussion of [illegible] [illegible] and methan[illegible] [illegible] mentioned [illegible] paragraph 4.[illegible]	23a-1[illegible]
Page [illegible] paragraph 4.3[illegible]: Give the source for [illegible] would [illegible] implies that the estimate was Mobil's.	23a-1[illegible]
Page 4-4[illegible], paragraph 4.337: Delete "lightweight rig", as it is not [illegible] by industry to be a feasible alternative	23a-127
Page 4-43, paragraph 4.352: First sentence does not state the extreme[illegible] [illegible] impact of right-of-way disturbance.	23a-1[illegible]
Page [illegible] paragraphs 4.354-366: Economic estimates should be quantified	23a-129
Page 4-47 paragraph 4.369: State that drilling fluids would consist of bentonite and water.	23a-130
Page 4-47 paragraphs 4.364,[illegible]: Similar operations in the Delta did not require the use of dikes.	23a-131
Page 4-[illegible], paragraph 4.376: Identify the volume and composition of drilling fluids and discuss directional accuracy.	23a-132
[illegible] Impacts of trenching across a river	23a-133

23a-124. The text has been revised to include [illegible] the potential [illegible] drilling wastes.

23a-125. The text has been revised to [illegible] the [illegible] of [illegible] methane on the water surface in paragraph 4.2[illegible]

23a-126. The text has been revised to indicate the source as U.S. Geological Survey, 19[illegible], as presented in U.S. Army Corps of Engineers, 1982a.

23a-127. The text has been revised by [illegible] the term "lightweight" [illegible] [illegible] the word "[illegible]" [illegible]

23a-128. The text [illegible] [illegible] short [illegible] would [illegible]

23a-129. Some [illegible] costs for an [illegible] system [illegible] added to the text (paragraph 4.364) based on Seaton 19[illegible].

23a-130. See response to comment [illegible]

23a-131. The fact that past pipeline installations in the Delta did not include use of a dike does not preclude [illegible] a dike in future installations, depending upon site characteristics. A dike around the exit hole of a boring seems particularly plausible. The text has been revised to indicate that dikes may not be needed.

23a-132. The text has been revised to describe the composition of drilling fluids as simple bentonite drilling muds similar to those used in geophysical exploration. The volume of these fluids is determined by the diameter and length of the borehole. Although the accuracy of this method is reported to be very good, the exact results will largely depend on site conditions.

23a-133. The text states that about 1 acre of benthic habitat would be affected per 1000 feet of pipeline length. The text has been revised to indicate that habitat would only be affected until recovery occurred.

[illegible] Define the relative magnitude of impacts [illegible] the value of benthic habitat, and [illegible] areas from the resulting turbidity." 23a-133 cont.

[illegible] 4.392, 393: An estimate should be given [illegible] that a navigation channel would be [illegible]ation. 23a-134

[illegible] The statement that wetland [illegible] completely lost for the life of [illegible] references indicate that [illegible] within two years, and because of [illegible] the dikes, much of the revegetation [illegible] 23a-135

[illegible] paragraph 4.411: The natural revegetation would not [illegible] to upland species. In the Mobile Delta, spoil dikes [illegible] revegetated by bottomland hardwood and [illegible] swamp species. 23a-136

[illegible] paragraph 4.412: The estimated recovery-time for [illegible] of 30-50 years is unrealistically high and [illegible] would preclude the long recovery times [illegible] spoil dikes adjacent to a slip dredged [illegible] Delta [illegible] had settled to near pre-project elevation within two years. 23a-137

[illegible] paragraphs 4.420,421,422: Range of severence taxes [illegible] 23a-138

[illegible] Economic benefits should be [illegible] they are for certain activities, industries [illegible] 23a-139

[illegible] paragraphs 4.449,460,473,485: [illegible] solid wastes should be added to [illegible] 23a-140

RESPONSE TO COMMENTS

23a-134. Paragraph 4.392 has been revised to indicate that navigation could be affected for only a few days.

23a-135. The text has been revised to refer only to those areas that would remain as open water or be buried under board roads during the life of the well site. A discussion has been added at paragraph 4.400a on revegetation of dredged material piles.

23a-136. The comment is correct in stating that revegetation would not be limited to upland species. The text has been revised by eliminating paragraphs 4.411 and 4.412 and adding a new discussion of revegetation beginning at paragraph 4.400a.

23a-137. The estimated succession time of 30 to 50 years is not unrealistically high and, in fact, may be low. Succession to climax from bare soil on upland sites in the eastern United States is typically 100 to 150 years. The much more rapid rate of *succession postulated* in the Delta is based on observation (as stated in paragraph 4.529) and on the likelihood that the rate of the process is enhanced on forested floodplains by the annual flooding which serves as a nutrient source and source of seeds and organisms.

The comment is correct in stating that refilling of the canal and slip from field abandonment would probably occur before 30 to 50 years. Observation in the Delta indicates that compaction of dredged material piles would probably vary depending on soil conditions at a particular location.

23a-138. Potential revenues from the severence taxes and royalties for one barrel of oil and 1,000 cubic feet of gas have been added to the text as paragraph 4.422a.

23a-139. Potential annual income earnings from direct labor have been added to paragraph 4.423.

23a-140. These paragraphs reference methods of disposal described in paragraphs 4.332 and 4.358.

[illegible] accident is assumed.

Page [illegible]: An accident is assumed [illegible] and the [illegible] is not mentioned.

[illegible] features.

Page [illegible] was the actual concentration of hydrogen [illegible] discovery (the only discovery of [illegible] to date) not used in the modeling [illegible] impacts for the Delta? The [illegible] sulfide was used to model [illegible] of the Bay, Sound and offshore, and [illegible] aspects of impacts for the Delta.

Page [illegible]: Projection of the 100 ppm hydrogen sulfide [illegible] consistent with the actual gas content of [illegible] in the Delta.

Page [illegible]: First sentence is not accurate, not all current [illegible] canals/slips in the delta require the restoration as described.

Page [illegible]: The placement of "clean material", alluvial sand in the case of one current permit, would not equal the impacts of the original project. Turbidity/suspended solids should be significantly decreased.

Page [illegible]: The specific methodology of slip [illegible] has not been required. To date, on [illegible] In this to be the requirement for future

RESPONSE TO COMMENTS

23a-141. The discussion centers on the potential for aquifer contamination to occur due to material [illegible] for enhancement. An accident is not necessarily assumed as the potential could exist based upon natural geologic conditions which could not be foreseen or prevented.

23a-142. See response to comment 23a-44.

23a-143. The [illegible] report was to discuss accidents completely in a single or as few [illegible] as possible. [illegible] individual applicant for a permit to develop and operate a well has to submit elaborate plans and analyses to the appropriate regulatory agencies.

23a-144. The text has been revised to include reference to the Superior [illegible] data for the Delta.

23a-145. See response to comment 23a-144. Based on Superior's experience the 100 ppm isopleth would not be observed. However, this presumes that no concentration of [illegible] greater than 48 ppm will ever be found. We do not think that it is a very conservative approach to use the only concentration found as the basis for an answer which could [illegible] the safety of the public.

23a-146. The text has been revised to indicate that a recent permit requires restoration as described.

23a-147. If the fill material is alluvial sand then less turbidity indeed would be generated. However, automatic use of sand is not an assumption of this EIS. The text has been revised to include this point.

23a-148. The text has been revised to indicate that the restoration procedure described is that required on the most recent permit issued for the Delta.

permits ?

Page 4-124, paragraph 4.529: Unscientific bias on expressing the amount of time required for site recovery. Relatively small, restored areas are compared directly with much larger projects that were not restored. Evidence cited within the GEIS indicates that wetland values will return quickly, often within two years. 23a-149

Page 4-125, paragraph 4.531: It is not clear from this discussion whether the impacts are positive or negative. 23a-150

Page 4-125, paragraph 4.532: The statement that "recovery could occur within 30 years...." is grossly misleading and should be changed to reflect evidence presented elsewhere in the GEIS, as well as empirical evidence from slips within the Delta. 23a-151

Page 4-126, paragraph 4.537: If restoration activities produce the same environmental impacts as the original project, an analysis of the advisability of restoration would seem appropriate. 23a-152

Page 4-127, paragraph 4.544: Identify magnitude of state and local revenues. 23a-153

Page 4-129, paragraph 4.550: Misleading; the discussion disregards environmental benefits during early succession. 23a-154

Page 5-4, paragraph 5.12: Incorrect statement of disposal practices from seismic boats. 23a-155

Page 5-4, paragraphs 5.14, 5.15: Emissions from helicopters and boats are minor and this should be stated in these two paragraphs. 23a-156

RESPONSE TO COMMENTS

23a-149. The text has been revised to indicate that the 30 to 50 year period may be a probable maximum for the forested Delta based on observation of a recovered site that received no planted trees. The EIS does not state that "wetland values will return quickly, often within two years" for the forested Delta.

23a-150. Paragraph 4.531 is only a description of what kind of revegetation might occur at a refilled canal site in the southern treeless portion of the Delta.

23a-151. See response to comments 23a-137 and 23a-[illegible].

23a-152. Comment noted. The Mobile District is constantly reviewing permit requirements as additional information becomes available.

23a-153. The magnitude of state tax revenue loss possibly resulting from abandonment has been added to paragraph 4.544.

23a-154. The text has been revised to indicate that vegetation succession following abandonment would regain those wetland values lost during the period of [illegible] right-of-way maintenance. The effect of maintenance of the right-of-way is discussed beginning at paragraph 4.402.

23a-155. See response to comment [illegible].

23a-156. The data presented in Table 5-2 adequately illustrates the magnitude of the emissions.

Page 5-6, Table 5-2: The procedures for calculating annual emissions (tons per year) from helicopters and boats should be referenced (Appendix G-II, page 2-49, Table 2-29).	23a-157
Page 5-8, paragraph 5.26: Incorrect description of disposal of treated wastewater.	23a-158
Page 5-8, paragraph 5.25: Replace terms "simple compounds" and "additive" with bentonite and water.	23a-159
Page 5-10, paragraph 5.33: Typical inland barge cannot enter waters less than 9 feet deep without dredging.	23a-160
Page 5-12, paragraph 5.34: Incorrect assumption at this time that steel sheetpiling will be installed by all operators. Sheetpiling is not installed as a spill containment measure.	23a-161
Page 5-13, paragraph 5.41: The evidence that natural forces produce more turbidity and suspended solids than does dredging is greatly understated. This is especially true when put in context of dredging for hydrocarbon exploration and production activities which is much less than the dredging required for maintenance of navigation channels.	23a-162
Page 5-14, paragraph 5.44: If it is recognized that oyster bed and grass beds could be affected by certain activities, why were the impacts on these resources not stated ? Very shallow discussion of true impacts. Detailed analysis would clearly reveal no long-term significant adverse impacts.	23a-163
Page 5-14, paragraph 5.45: What is the quantified value of grassbeds that would be affected ?	23a-164

23a-157. The text [illegible]

23a-158. See response to comment [illegible]

23a-159. See response to comment [illegible]

23a-160. The text has been revised to [illegible] barge is about 8 feet [illegible]

23a-161. The text has been revised [illegible]

23a-162. See response to comment [illegible]

23a-163. Paragraph [illegible] preparation for drilling barges [illegible] of the communities by the material [illegible] continued loss of [illegible] the drilling site and on the production [illegible] of all future postulated well sites [illegible]

23a-164. Paragraph [illegible] states that [illegible] by placement of a shellpad [illegible] discussed in paragraph [illegible]

Page 5-16, Table 5-3: For emissions from "Geophysical Exploration," "Drilling," and "Production," footnote a should reference Table 5-2. For "Rig Operation," footnote (b) should reference Appendix G-II, page 2-36, Table 2-18 and explain that these are maximum allowable emissions from a single rig as indicated in a PSD permit for one operator. Other operators have experienced lower emissions for a single rig, which were less than 250 tons/year for NOx. [illegible] value [illegible] is for [illegible] rigs, [illegible] one. 23a-165

Page 5-[illegible], paragraph 5.[illegible] [illegible] the [illegible] impacts [illegible] channels were considered [illegible] Chapter [illegible] [illegible] channels not included in the draft general permit ? Biased statement of insignificant impact. Not merely "would not be expected to be as severe as those of the navigation channels", but extremely less severe and insignificant. 23a-[illegible]

Page 5-20, paragraph 5.63: In the discussion of a rig possibly being sited on oyster and grass beds, [illegible] impacts of such actions should be considered and clearly stated. Biased statement of insignificant impact. Merely because an activity has the possibility to cause an effect on an especially valuable community (whatever that means) does not mean [illegible] is significant. 23a-167

Page 5-2[illegible], paragraphs [illegible]: The discussion of wastewater disposal is inaccurate. Also the [illegible] reference [illegible] consensus decision [illegible] clearly [illegible] the no-discharge rule should be cited. 23a-168

Page 5-26, paragraph 5.93: The projected impacts of founding a rig on oyster reefs and grassbeds should be considered and clearly stated. 23a-169

Page 5-26, paragraph 5.94: The statement concerning the storage and ultimate disposal of ballast water is incorrect. Alabama regulatory agencies have allowed the in situ discharge of ballast waters for past and current operations in the study area. 23a-170

Pages 5-27 through 5-32: Disproportionate discussion of that 23a-171

RESPONSE TO COMMENTS

23a-165. The text has been revised to include the suggested footnotes. Comment noted. See response to comment 23a-84.

23a-166. The cooperating agencies believe that dredged channels require individual review for two reasons. First, the width, length and depth of a proposed action is highly variable. The agencies do not wish to allow a several thousand foot channel to be dredged without specific review. Second, location is very important relative to sensitive resources, which could be degraded unless site-specific mitigation measures are considered. The statements in this paragraph are not considered "biased". The EIS does not label impacts as significant or insignificant. The reader can make a judgement as to the magnitude of the impact based on the several reasons listed.

23a-167. The effects of the loss of benthic area during drilling operations are stated in paragraph 5.63. The ecological value of submersed aquatic vegetation and oyster reefs are discussed in the EIS. Paragraph 5.[illegible] states that the effect of routine drilling operations would not extend beyond the immediate vicinity of the well site. The cumulative effect of all drilling sites on benthic communities is discussed in Chapter 6.

23a-168. The text has been revised to show that the no-discharge position applies to well sites within the delta, bay, sound and state Gulf waters. The [illegible] information presented in Paragraph 5.64 is [illegible] based on a personal communication with the [illegible] Environmental Management. Any potential discharge [illegible] site must be evaluated through the state discharge permit process and may result in the development of a case-specific "zero discharge" agreement. [illegible] the ADEM position is also stated in a September 21, 1984 letter [illegible] Corps.

23a-169. Paragraph 5.93 states that about 0.[illegible] to 0.[illegible] acres [illegible] submersible drilling rig. The cumulative effects of the number of drilling sites projected for the study region is discussed [illegible].

23a-170. See response to comment 23-16. Ballast waters have been allowed [illegible].

23a-171. Comment noted. See response to comment [illegible].

which has minor to insignificant impact on noise. The effects of noise from rigs, [illegible] by the time it reaches shore should be negligible. Onshore staging areas may be noisy, but will probably be [illegible] in areas where ambient noise levels are high already [illegible] areas. [illegible]

Page [illegible], paragraph 5.129. The rationale should be stated for [illegible] water quality impacts due to the [illegible] of a canal which, by fundamental assumption, would [illegible] 23a-172

[illegible] paragraph [illegible]. The construction of a canal and slip [illegible] would not have essentially the same impacts [illegible] construction in the Delta. Because of significant differences in land elevation, more dredging and dredged material would result from construction in the Delta. 23a-173

Page [illegible], paragraph [illegible]3. It should be clearly stated that the loss of marsh would eliminate the area as nursery and feeding areas only for the life of the project. 23a-174

Page [illegible]-39, paragraph 5.137: Biased statement of turbidity effects from hydrocarbon exploration and production dredging operations. It is clear that natural forces and other activities [illegible] many times the turbidity levels of the analyzed activity. 23a-175

Page [illegible]39, paragraph 5.142: Solid wastes produced in the construction of a canal/slip in salt marsh would be less than those produced from similar construction in the Delta, because of significant differences in elevation. 23a-176

Page [illegible]-41, paragraph 5.147: Justify the projection of long-term water quality impacts with the underlying assumption of site restoration. 23a-177

Page [illegible]. Cite evidence for the stated incompatibility of 23a-178

23a-172. long-term [illegible] canal restoration would [illegible] activities [illegible] completed [illegible] response to [illegible] duration [illegible] the impact [illegible]

23a-173. [illegible] has [illegible] would probably [illegible] be less in a salt [illegible]

23a-174. [illegible] text has been revised [illegible]

23a-175. [illegible] District disagree [illegible] [illegible] [illegible] considerati[illegible] by the District [illegible]

23a-176. Comment [illegible]

23a-177. See response [illegible]

23a-178. [illegible]

[illegible] on platforms. Does the [illegible] Coastal Louisiana and Texas [illegible] | 23a-178 cont.

[illegible] impacts due to [illegible] probability of [illegible] the public interest of [illegible] | 23a-179

[illegible] statement of disposal of [illegible] | 23a-180

Page [illegible] it is stated that pipelines constructed [illegible] would result in the "loss" of that resource. [illegible] recovery of grassbeds following construction [illegible] considered. If conditions were proper for the establishment [illegible] grass pre-project, why would they not recover [illegible] inadequate impact analysis of effects on grass beds [illegible] that any loss, no matter how small or restorable, is [illegible], is improper. | 23a-181

Page [illegible] paragraph states that oysters in a pipeline [illegible] would be "lost" as a result of construction [illegible] should be given to possible recolonization [illegible] which would reconstruct the reef. | 23a-182

Page [illegible] paragraph [illegible] an assumption is made that all channels would be crossed by directional boring. This is not necessarily true [illegible] of trenching across minor channels should be stated. | 23a-183

Page 5-75 [illegible] paragraph [illegible] it is stated that the installation of pipelines through wetlands would cause some loss in the ability of the wetland as a whole to maintain favorable water quality. [illegible] should be stated that this impact would be very short-term. | 23a-184

[illegible] benefits during pipeline | 23a-185

RESPONSE TO COMMENTS

23a-179. Probabilities of well blowouts and pipeline ruptures occurring in open waters are given in paragraphs [illegible] 314 and 4.509 respectively. Clearly, probabilities vary depending upon design, installation and operation-maintenance procedures. The text has been revised to present this concept.

23a-180. See response to comment 23-10.

23a-181. Paragraph 5.253 is a discussion of the effect of pipeline construction, which would be the loss of the seagrass resource during the construction period. The text has been revised to mention the construction period. The text has been revised in the section on normal operation of pipelines (beginning at paragraph 5.274) to discuss the recovery of the affected area after refilling of the trench.

23a-182. Paragraph 5.254 is a discussion of the effects of pipeline construction, which would be the loss of the oyster reef. The text has been revised to mention the construction period. The text has been revised in the section on normal operation of pipelines (beginning at paragraph 5.274) to discuss the recovery of the affected area.

23a-183. The text does not state that all channels would be crossed by directional boring but that such boring would be likely for major channels (e.g., the main Mobile Bay channel) and that smaller channels may be crossed by trenching. Paragraph 5.236 includes a discussion of both directional boring and trenching as modes of channel crossing.

23a-184. The loss of wetlands due to pipeline installation would extend from the time the pipeline path is excavated until wetland vegetation is restored. See response to comment 23a-151 for duration of the natural revegetation process in the Delta. Such an impact is not clearly short-term. The text has been revised to clarify this point.

23a-185. New information has been added as paragraph 5.261a itemizing potential costs of an offshore pipeline. The effects to the local area would depend on the residence of workers and where materials are purchased, which may or not be the local area.

construction are vague and unquantified, continued understatement of economic benefits. 23a-185 cont.

Page 5-80, paragraph 5.294: The dollar-value of revenues should be estimated and stated. 23a-186

Page 5-84, paragraph 5.312: Because check valves will be used in all pipeline construction, this section should estimate the realistic maximum volume that would be [illegible], instead of stating "considerably less than 300,000 gallons would be spilled." 23a-187

Page 5-85 through 88: In the discussion of abandonment impacts in the Bay and Sound, no mention is made of the restoration of environmental values. Of what value is restoration if not to allow and speed environmental recovery ? 23a-188

Page 6-3, paragraph 6.9: Revise second sentence as follows: Air gun operations, the normal mode, do not produce the massive energy pulse that unconfined explosives produce." Change third sentence to read: While unconfined explosives are known to kill fish in the immediate vicinity and produce injuries farther away, air gun operations are not known to damage marine life (Gilbert, 1953). 23a-189

Page 6-3, paragraph 6.10: Incorrect description of the handling of treated wastewater. 23a-190

Page 6-3, paragraph 6.13: In the discussion of vapor storage, it is unclear as to the source of vapor, and reason for same. 23a-191

Page 6-6, Table 6-2: In footnote (a) the units should be included on the equation, and the origin of the emission factor (Appendix G-II, page 2-49, Table 2-29) should be noted. Without this information the calculation in footnote (a) is not clear. In footnote (b) "2000 days/year" should be "200 days/year." Also, in footnote (b) an emission factor of 1.69 gram/hour has 23a-192

RESPONSE TO COMMENTS

23a-186. Potential state revenues from severence taxes, maintenance taxes, and royalties have been added as paragraph 5 294a.

23a-187. The text states that check valves are used along the pipeline. Text has been revised to indicate that no check valves would be used between production platform and the pipeline landfall, but would be placed at intervals along the on-land portion of the line. The quantity of material spilled, however, would be variable depending on the offshore length of the line, the on-shore length, and the distance between check valves on land.

23a-188. The text has been changed to indicate that environmental values could be regained after abandonment.

23a-189. The text of pararaph 6.9 has been revised to reflect this comment.

23a-190. See response to comment 23-10.

23a-191. The text has been revised to clarify "vapor storage" as the vapor emissions from hydrocarbon storage.

23a-192. The text has been revised to correct the emissions calculations. The corrections represent approximately 2% increase in total emissions, less than the accuracy of the subsequent modeling. Therefore the corrections have not been carried forward to the modeling effort.

[illegible] emission factor is [illegible] the calculation procedure [illegible] emissions [illegible] therefore understated [illegible] emissions are 36 tons [illegible] — 23a-192 cont.

Page [illegible] Table [illegible] The stated [illegible] value is for 4 rigs, not one. [illegible] "Drilling", and [illegible] Table 4-3. For "Rig [illegible] Appendix G-1, page 2- [illegible] maximum allowable [illegible] permit for one operation. [illegible] experienced lower emissions for a single [illegible] tons/year NOx. — 23a-193

Page [illegible] paragraph [illegible] should be stated that recreational fishing is greatly [illegible] in the vicinity of platforms — 23a-194

Page [illegible] This paragraph should be rewritten to correct the [illegible] barium, chromium, etc. are [illegible] available form [illegible] drilling muds. These elements are not present [illegible] form [illegible] drilling fluids. As to the discharges [illegible] it is suggested that this section be revised [illegible] from the following reference: DRILLING [illegible] ENVIRONMENT, National Research Council, [illegible] Press, Washington, D.C. 1983. — 23a-195

Page [illegible] The amount of wages should be quantified. — 23a-196

Page [illegible] seagrass beds are destroyed by [illegible] would they recover? A statement should be made as to [illegible] natural recovery following construction activities. [illegible] loss [illegible] significant impact [illegible] recovery and mitigation should be analyzed. — 23a-197

Page [illegible] wages and royalties should be quantified. — 23a-198

RESPONSE TO COMMENTS

23a-193. See response to comment 23a-84. The table has been revised to include the Appendix G reference. However, maximum allowable PSD emissions are treated throughout the text and do not warrant mention as a footnote.

23a-194. The text has been revised at paragraph 6.120 to mention that offshore platforms are popular fishing spots.

23a-195. Barium, chromium and iron are good indicators for detecting drilling mud in the Gulf of Mexico (Trocine and Trefry, 1983). Paragraph 6.73 was also not meant to discuss allowable discharges in OCS waters. Revisions to paragraph 6.73 have been made.

23a-196. Potential earnings of workers from platform construction and installation, based on U.S. Department of Labor (1983) weekly medians, have been added to paragraphs 5.238 and 5.239. Paragraph 6.90 has been revised to reference the new information in Chapter 5.

23a-197. Paragraph 6.102 discusses the effect of pipeline construction activities, which would result in the loss of seagrasses in the construction zone and possible alteration of adjacent areas from redeposition of suspended sediment. The text has been modified in the section on normal operations of pipeline systems (paragraph 6.114a) to discuss recovery of seagrasses after refilling the trench.

23a-198. Paragraph 6.110 is an introductory paragraph, not intended for details. Paragraph 6.120 has been revised to reference the new information in Chapters 4 and 5. See responses to 23a-138, 23a-139 and 23a-186.

Page 6-32, paragraph 6.119: The last sentence needs justification, or deletion. 23a-199

Page 6-33, paragraph 6.123: Royalty payments and taxes should be quantified. 23a-200

Page 7-9, paragraph 7.35: The statement is made that for exploration in uplands, a cultural resources survey is required. Documentation for this requirement should be given. 23a-201

Page 7-11, paragraph 7.47: Taxes should be quantified. 23a-202

Page 7-12, paragraph 7.57: Quantify taxes, salaries. 23a-203

Page 7-13, paragraph 7.60: It should be stated that a plant would require an NPDES permit, and therefore additional environmental review. 23a-204

Page 7-14, paragraph 7.69: Quantify wages, etc. 23a-205

Page 7-16, paragraphs 7.80, 7.81: Continued nonstatement of range of economic benefits. Wages, etc. should be quantified. 23a-206

Page 7-18, paragraph 7.92: This section ignores the regulatory review and safeguards required by the Alabama Oil and Gas Board and Alabama Department of Environmental Management. 23a-207

Page 7-20, paragraph 7.100: The value of production is not stated. 23a-208

RESPONSE TO COMMENTS

23a-199. The text has been revised to clarify the concept of "maintenance".

23a-200. See response to 23a-198.

23a-201. The text of paragraph 7.35 has been revised.

23a-202. Reference to Chapters 4 and 5 in paragraph 7.47 indicate where taxes and royalties are quantified on a unit basis.

23a-203. Potential costs for an onshore pipeline has been added to Chapter 4. A reference to this new information has been added to paragraph 7.57. See response to comment 23a-129.

23a-204. The text has been revised to include the environmental review requirements for NPDES permits.

23a-205. Potential wages earned weekly have been added to paragraph 7.69.

23a-206. Potential weekly wages earned in the construction trade have been added to paragraph 7.81.

23a-207. The Unit Action Analysis (Chapters 4-7) presents potential impacts. Mitigation such as regulatory review and safeguards are presented in Chapter 10.

23a-208. An estimated value of production and annual wages generated by a facility with a throughput rate of 43,000 barrels has been added to paragraph 7.100.

Page 7-22, paragraph 7.114: Quantify wages and value of products. 23a-209

Page 7-28, paragraph 7.148: A cultural resources survey may not be required. Document requirement, or revise discussion. 23a-210

Page 7-29, paragrapr 7.153: The described restoration is regulated also by the State Oil and Gas Board, and should be so stated. 23a-211

Page 7-30, paragraph 7.160: Quantify wages and revenues. 23a-212

Chapter seven does not discuss the ultimate restoration of environmental values within the affected area. 23a-213

Page 8-2, paragraph 8.7: If changes in scenarios and/or impacts result from the reconsideration of resource estimates, the public should be allowed additional time to review and comment on the revised document. 23a-214

Page 8-7, paragraph 8.12: There ar currently six access ca[illegible]ls/barge slips in the Mobile Delta [illegible]ne has been refilled). Evic[illegible]nce should [illegible]e cited for the conclusion that a maximum of nineteen additional canals/slips would cause changes in regional erosion patterns. Have the existing canals/slips caused regional changes in wetland erosion patterns ? 23a-215

Page 8-7, paragraph 8.13: Circulation/exchange within a canal is not "limited" during periods of high water. 23a-216

Page 8-10, paragraph 8.24: The percentage of wetlands affected in the Delta should be stated (0.5%). 23a-217

Page 8-11, Table 8.4: LOCATIONS RESTORED is a missing category 23a-218

RESPONSE TO COMMENTS

23a-209. An estimate of annual wages and value of the product has been added to paragraph 7.114.

23a-210. The text of paragraph 7.148 has been revised.

23a-211. The text has been revised to mention the state oil and gas board.

23a-212. Paragraph 7.160 in the draft EIS contains a description of the dismantling of a drilling rig rather than a discussion of the abandonment of a producing well site. This has been corrected in the final EIS. [illegible] chapters where taxes and royalties are quantified.

23a-213. The text has been revised in the Abandonment section to indicate that the vegetation communities that develop at well sites and on pipeline corridors would depend on use made of these areas by landowners after abandonment. [illegible] facilities and service bases indicates that future use of these facilities and sites would determine what happens to these sites.

23a-214. The resource estimates have not been changed in the final EIS. [illegible] new hydrocarbon discoveries have occured since the estimate was made. [illegible] has been deleted from the final EIS. A 30-day review period is allowed on the final EIS.

23a-215. Changes in wetland erosion patterns are identified as possible effects. Experience in the deltaic marshes of Louisiana suggest that erosion in the Mobile River Delta marshes could occur.

23a-216. See response to comment 23a-29.

23a-217. The text has been revised to state the percent of area affected.

23a-218. The calculation of area of wetlands affected is a worst-case analysis that represents the cumulative area altered over the [illegible]-year period. [illegible] hole sites and abandonment of exhausted fields during the [illegible]-year period would reduce the area affected. The text has been revised in paragraph [illegible] to [illegible] this fact.

that should be added to each scenario.

Page 8-14, paragraph 8.30: What is the significance of loss increase for the particular category of activity ? Convenient way to bias figures. What is important is loss increase due to this activity = 0.5 percent without restoration. 23a-219

Page 8-14, paragraph 8.31: This section assumes complete loss of forested wetlands, and ignores the restoration requirement. 23a-220

Page 8-16, Table 8-7: The projected increase in the wetland area altered, by scenario, expressed as a percent increase, has little meaning and is in fact deceptive when no statement is made as to environmental impact of the projected alterations. 23a-221

Page 8-17, paragraph 8.32: The discussion of percent increase is, at best, confusing and biased. What is the environmental significance of such a presentation ? *Impacts need to be stated.* 23a-222

Page 8-17, paragraph 8.36: Do not bury percent increase in the table. State percent increase in the narrative. 23a-223

Page 8-19, paragraph 8.37: The assumption of complete loss ignores the restoration requirement. How small is the "loss" ? This industry has a right to extract hydrocarbon resources, and the magnitude of the loss versus the magnitude of benefits should be stated. 23a-224

Page 8-21, paragraph 8.43: This section states that pollution potential is not quantifiable for groundwater resources. What, then, is the basis for statements elsewhere in the GEIS that assume accidents and chronic contamination of area groundwater resources ? 23a-225

Page 8-22, paragraph 8.45: The entire treatment of groundwater 23a-226

[illegible]

23a-219. The purpose of [illegible] considered [illegible] the scenarios [illegible] clearly stated [illegible] paragraph [illegible]

23a-220. The text has been revised [illegible] until restoration occurs [illegible]

23a-221. Table 8-7 has been revised [illegible] current area and to state the [illegible]

23a-222. The text has been revised [illegible] area altered. The effect of [illegible]

23a-223. The percent of non-forested wetland area altered [illegible] assumptions has been added to paragraph [illegible]

23a-224. Very few wetland areas [illegible] is highly unlikely that pipeline landfalls from Mobile Bay would [illegible] Mobile Bay. A discussion of the [illegible] pipeline construction [illegible] wetlands is given in Chapter 4. The District agrees that [illegible] right to extract hydrocarbons for which valid mineral leases have been obtained. However, extraction of the resource must be carried out in [illegible] with the [illegible] and regulations established [illegible] could be affected by industry activities. [illegible] the rights of others are protected [illegible] to extract hydrocarbons legally obtained. The purpose [illegible] information to public decision makers [illegible] responsibilities based on the best [illegible] available [illegible] parties are protected.

23a-225. The text has been revised [illegible] contamination of groundwater are assumed [illegible] exists for such contamination.

23a-226. See response to comment [illegible]

impacts is misleading and should be revised throughout the document. 23a-226 cont.

Page 8-25, paragraph 8.54: This paragraph continues the strange, misleading discussion of groundwater impacts. If the writers cannot determine the pollution potential for groundwater, why have accidents been assumed throughout ? 23a-227

Pages 8-21 through 8-25: The discussion of impacts to groundwater is biased and the length of discussion is not proportional to the insignificant impact. 23a-228

Page 8-27, paragraph 8.62: Nine rigs per tract at any one time is not realistic, even in worst-case modeling exercise. 23a-229

Page 8-29, 30, paragraphs 8.72, 8.73: The discussion of noise includes cumulative noise, but excludes cumulative impact; need to relate numbers to projected impacts. Again, the length of discussion is not proportional to the insignificance of impact, contrary to NEPA regulations. 23a-230

Page 8-36, paragraph 8.94. Cultural resources survey may not be required if DOA permit is not required. 23a-231

Page 8-36, paragraph 8.97: It is stated that accident probabilities for loss of well control in wetland areas cannot be quantified. How would these probabilities differ from loss of well control offshore ? Were these impacts not considered in the 1975 FEIS for a wildcat in the Mobil Delta ? 23a-232

Page 8-38, paragraph 8.98: The probability of an accidential release of hydrogen sulfide should be clearly stated, not given in exponential form. 23a-233

Page 8-39, paragraph 8.101: The impacts of constructing a 23a-234

23a-227. If the potential for groundwater contamination exists for any aspect of oil and gas exploration and production then this potential is identified, regardless of the likelihood of such contamination occurring. For the majority of the situations, the potential for contamination is low with current safeguards. Also see response to comment 23-11.

23a-228. See response to comment 23a-227.

23a-229. Comment noted.

23a-230. The text has been revised to include cumulative impact as it relates to the noise levels presented. Also refer to Appendix E for additional comparative data. See response to comment 23-11.

23a-231. The text of paragraph 8.94 has been revised to clarify the survey requirements.

23a-232. Paragraph 8.97 states that probabilities of a wide variety of types of a [illegible] cannot be quantified. The probability of losing well control is [illegible] independent of well location, assuming placement of the [illegible] difficult in particular type of environments. The text has been [illegible] this point.

23a-233. The text of paragraph 8.98 has been revised to show incident frequency in terms of the number of years for such an incident to occur.

23a-234. Impacts are not acknowledged to be minor, rat[illegible] small). The reader is left to make conclusions [illegible]. The statement referred to in paragraph 8.103 is a [illegible] access channels and navigation channels. We did not anticipate [illegible] amount of dredging with a statement about access and [illegible] "minor" to Paragraph 8.103 has been revised.

maximum of three access channels @ 21,400 cubic yards each are acknowledged to be minor (versus 13,700,000 cubic yards to maintain navigation channels), but, in paragraph 8.103, it is stated that "The impacts of the access channels would not be expected to be as severe as those of the harbor and bay navigation channels,....". This obvious understatement encourages the false "equality": minor = less severe. 23a-234 cont.

Page 8-40, paragraph 8.105: This paragraph is unfortunately typical of many that postulate impossible activities, describe adverse impacts, and then finally state that the activity, as described and analyzed, could not be performed. If, in fact, both Alabama and Mississippi require pipeline trenches to be backfilled, why are open trenches and their associated impacts even considered ? 23a-235

Page 8-41, paragraph 8.111: The GEIS should have considered the impacts of pipelines crossing wetlands in Mobile County, too. 23a-236

Page 8-42, paragraph 8.116: This paragraph acknowledges a very significant fact that previously has been omitted: Resource development activities will TEMPORARILY alter some parts of the study area over the projected 30-year period. Most other discussions of impacts imply or assume long-term, irretrievable losses. Also, the statement that drilling locations will have a "very small effect on the bay ecosystem..." if no dredging is required implies that dredging a maximum of three access channels (high resource scenario) would significantly increase environmental effects. 23a-237

Page 8-44, paragraph 8.119: This paragraph should state that the total affected area, even under the high resource scenario, would be about one percent of the total Bay. 23a-238

Page 8-44, paragraph 8.120: If impacts cannot be determined, but are considered to be minor, what is the basis for "concern" ? Also, the percentage of area disturbed increased from paragraph 8.119 ([illegible]%) to paragraph 8.120 (1.5%). 23a-239

Page 8-45, paragraphs 8.122, 8.123, 8.124: These paragraphs, as 23a-240

23a-235. Comment noted. The impacts [illegible] for the backfilling requirements.

23a-236. See response to comment [illegible]

23a-237. [illegible] permanent [illegible] case. [illegible]

23a-238. The paragraph states [illegible]

23a-239. Paragraph 8.120 [illegible] site-specific [illegible] consistent [illegible]

23a-240. See response to comment [illegible]

... potential for groundwater ... empirical evidence ... not occur as the result of | 23a-240 cont

... This section gives a ... 223-... million gallons, but ... of that production. | 23a-241

... "... ted" on site; ... accordingly. | 23a-242

... discussion of noise includes projected ... not state projected impacts. Would ... existing, ambient levels in the ... discussion of an insignificant impact. | 23a-243

... This discussion needs to be rewritten to ... loss of fishing area is not permanent. Cite ... for impact to trawl maneuvering. | 23a-244

Page ... This discussion suggests potential ... but then states that new oil docks, once abandoned ... utilized by the fishing industry. What impacts are ... Are they positive or negative ? | 23a-245

Page ... Cite evidence that accident probabilities are a function of rig spacing. | 23a-246

Page 8-54, paragraph ... Why was pipeline emplacement across a barrier island not considered ? Such installation has been completed ... elsewhere. For the GEIS to be complete and satisfy ... crossing of barrier islands should be analyzed as a reasonable ... | 23a-247

Page 8-... impacts of locating a rig in | 23a-248

RESPONSE TO COMMENTS

23a-241 Impacts of produced wastewater would vary depending upon the manner in which the wastewater is treated and disposed. Most of the wastewater (all quantities from well sites) would be transported to an approved upland wastewater system. Proper management of sanitary wastewaters is the responsibility of the appropriate state environmental agency. The text has been revised to consider this situation.

23a-242 The text has been revised to differentiate between construction and installation.

23a-243 Appendix E, page 5 contains comparative noise levels of generic ambient noise producing activities. See response to comment 23-11.

23a-244. The text of paragraph 8.151 has been revised. The reference cited for potential effects on trawling maneuvering (Centaur Associates, Inc., 1981) is based on actual, operational space requirements for such fishing. The presence of a rig or platform would remove a certain acreage from potential trawling operations since, in terms of fishing, it is an obstruction that could require maneuvering by the fishing vessel.

23a-245. The text of paragraph 8.156 has been revised regarding potential competition for dock space.

23a-246 The text has been revised to delete the reference to spacing.

23a-247. A discussion of the effect of pipeline crossings of barrier islands has been added to the EIS beginning at paragraph 5.273a.

23a-248. The effects of drilling in salt marshes of Mississippi Sound are discussed in paragraph 8.171

[illegible] Mississippi Sound [illegible] be considered. [illegible] for a complete DEIS. — 23a-248 (cont)

[illegible] Table 8-14: Accident frequency should be clearly [illegible] and not just shown mathematically. — 23a-249

[illegible] paragraph 8.[illegible]: It is stated that impacts due to [illegible] through Mississippi [illegible] and wetlands would be [illegible] site restoration [illegible] was [illegible] similar analysis [illegible] Mobile Bay [illegible] performed. — 23a-250

Page 8-[illegible], paragraph 8.176: This section discusses the importance of shallow-water areas as nurseries, but fails to discuss the effects of locating a rig or constructing pipelines through these waters, except to mention, in paragraph 8.177, that pipeline construction would have only a temporary effect. If the DEIS is to be complete and is to satisfy requirements of NEPA, activities in and through Portersville Bay and Cedar Point Reef should be analyzed. — 23a-251

Page 8-[illegible], paragraph 8.180: The discussion of chloride contamination should be rewritten to fairly represent the [illegible] for such contamination. — 23a-252

Page 8-[illegible], paragraph 8.186: The loss of fishing area is not permanent. Cite evidence for "maneuvering problems". — 23a-253

Page 8-[illegible], paragraph 8.191: Cite evidence for "indications" of [illegible] competition between oil and fishing interests. — 23a-254

Page 8-[illegible], Table 8-16: Incident frequency should be clearly stated in commonly-used lay terms — 23a-255

Page 8-[illegible], paragraphs 8.[illegible], 8.[illegible]: How would the potential for — 23a-256

RESPONSE TO COMMENTS

23a-249. The numbers in Table 8-14 have been revised to show incident frequency in terms of the number of years for such an incident to occur.

23a-250. See response to comment 23a-224.

23a-251. In preparing the generic Environmental Impact Statement the Mobile District has evaluated the general overall effects of postulated oil and gas resource development activities within the study region. This approach is encouraged under the tiering concept in the Council on Environmental Quality regulations regarding preparation of impact statements. Therefore, all site specific effects of oil and gas activities in the study region are not considered in detail. Under the tiering concept, the GEIS analysis would be built upon through the site specific studies of a specific proposed activity in Portersville Bay or the Cedar Point Reef area at the time a permit for such activities was requested from the District.

23a-252. See response to comment 23a-227.

23a-253. The text of paragraph 8.186 has been revised. Paragraph 8.186 states that the loss would only be for the life of the wells. See response to comment 23a-264 for discussion of evidence for potential effects on vessel maneuvering. The text does not use the words "maneuvering problems".

23a-254. The text of paragraph 8.191 has been revised regarding potential competition for dock space.

23a-255. The numbers in Table 8-16 have been revised to show incident frequency in terms of the number of years for such an incident to occur.

23a-256. The text has been revised to indicate that the potential for groundwater contamination in the Gulf area will be less than for the Delta and Bay areas based upon differences in resource estimate.

... [illegible] muds in Mississippi Sound be similar [illegible] the Delta given the significant differences [illegible] estimate ? | 23a-256 cont.

Page [illegible] 209, 210: Gallons of wastes are [illegible] potential impacts are not. | 23a-257

[illegible] estimates are stated, noise [illegible] biased discussion of [illegible] | 23a-258

Page [illegible] It should be stated that the loss of fishing [illegible] permanent. Cite evidence for "maneuvering problems | 23a-259

[illegible] What is the impact of platforms [illegible] | 23a-260

[illegible] is stated that the probability of [illegible] estimated for Mobile Bay. Recently [illegible] oil/gas activities in Mobile Bay [illegible] of major spills, and these data [illegible] | 23a-261

[illegible] incident frequency should be clearly [illegible] commonly used lay terms. | 23a-262

Page [illegible] 249. Impacts of lost habitat should be [illegible] | 23a-263

[illegible] If the overall impact of chloride [illegible] cannot be quantified, how can one [illegible] the total volume of produced [illegible] area aquifers such that "major | 23a-264

RESPONSE TO COMMENTS

23a-257. See response to comment 23a-241.

23a-258. See response to comments 23a-243 and 23-11.

23a-259. The text has been revised. See response to comment 23a-244. The text does not use the phrase "maneuvering problems".

23a-260. The impact of platforms covering 2 [illegible] 8 acres would be the loss of such areas as potential fishing areas. Whether such areas were, indeed, normally fished would depend on the specific location of rigs or platforms.

23a-261. All of the information we have been addressing spill probabilities pertain to spills in open waters (e.g., offshore Gulf of Mexico), as we discuss in our response to comment 23a-179. The probability of a well blowout may not differ in coastal waters as compared to open waters, but a pipeline rupture due to dragging of an anchor would likely have a higher probability of occurring in coastal waters. If the commenter can cite references in which spill probabilities in coastal (sheltered) waters are documented, the EIS preparers will be glad to utilize such information as appropriate.

23a-262. The numbers in Table 8-20 have been revised to show incident frequency in terms of the number of years for such an incident to occur.

23a-263. The generic effects of loss of upland areas are stated in paragraph 2.249. The particular effects would be site-specific and project-specific and would be considered as part of the permit application review process if a Department of the Army permit is required for the proposed action.

23a-264. The text has been revised to emphasize the probability of chloride contamination.

[illegible] for the concl[illegible]ion [illegible] will be "increased [illegible]" [illegible] were imported in the Mobile Bay area. [illegible] is not quantifiable, then the [illegible] should have [illegible] 23a-265

[illegible] shallow [illegible] 23a-266

[illegible] Sanitary wastes from support vessels [illegible] a municipal wastewater [illegible] under current practices. 23a-267

Page [illegible] paragraph 8.259: This paragraph overlooks several important [illegible] requirements:

[illegible] a new source, PSD is only applicable to one whose [illegible] exceed 250 tons/year of a single pollutant [40 CFR [illegible]]

[illegible] includes emissions from mobile sources [illegible] automobiles, and trucks), but PSD rules [illegible] exclude mobile sources from the source impact [illegible] [40 CFR 51.24 b(18)]. All mobile sources should be [illegible] from the PSD analysis. 23a-268

[illegible] source is subject to PSD, either as a major source or major modification, a Best Available Control Technology (BACT) [illegible] [40 CFR 51.24 [illegible]] and possibly ambient air monitoring [illegible] must be completed for each pollutant which exceeds the "de minimis emission rate."

The "de minimis ground level concentrations" are only used to determine if ambient air monitoring can be waived [40 CFR 51.24 [illegible]]. This requirement is alluded to in Appendix E-3, page E[illegible], "Oxides of Nitrogen Results" but needs to be clearly stated in this paragraph.

Page [illegible], paragraph [illegible]: This paragraph should state that [illegible] "de minimis emission rates" are possibly exceeded for 23a-269

RESPONSE TO COMMENTS

23a-265. The text has been revised to delete this paragraph as it is unclear and relatively unnecessary to the overall intent of the section.

23a-266. Land disposal of any solid waste, including dewatered drilling muds, provides the potential of aquifer contamination by leaching of contaminants into the shallow aquifer. All such potential contamination was discussed in the GEIS, regardless of relative probability of occurrence.

23a-267. See response to comment 23-10.

23a-268. Comments noted. The text (8.2[illegible]) and [illegible] Appendix [illegible] has been revised to indicate that although many PSD concepts are described and utilized in this analysis, this is not a PSD evaluation. The GEIS addresses all activities of oil and gas development which require that mobile emission sources attendant to this development be included.

23a-269. The text has been revised to include the possibility of ambient air quality monitoring. See response to comment 23a-84.

CO, NOx, and SO2 a BACT analysis and ambient air monitoring may be required for these pollutants. There is no other significance to this exceedance. CO values are for 4 rigs, not a single rig.

Page 8-96, paragraph 8.262. The origin of the 100 kilometer limit for considering the impact of a source on a Class I area should be cited. It is generally understood that EPA air dispersion models are only accurate up to a 50-kilometer distance. 23a-270

Page 8-96, paragraph 8.263. The significance of this paragraph and the 1.2 kilometer rig distance from the Class I area is unclear, since such a rig location is well out of the boundary of the study area. This should be clarified or deleted. 23a-271

Page 8.96, paragraph 8.264: PSD rules do not require that mobile sources (i.e. "all of the support peripherals" in the first sentence) be included (40 CFR 51.24(k) and 51.24(b)(18)). 23a-272

Page 8 - 103, paragraph 8.272. In the fourth sentence "the less than symbol" appears to have been omitted from 10 ug/m3 impact. 23a-273

Page 8 - 103, paragraph 8.275: The only significance of this paragraph is that ambient air monitoring of NO2, CO and SO2 may be required. This should be stated. 23a-274

Page 8 - 103, paragraph 8.276: This is an incorrect statement. The determination of PSD applicability is based on whether a new source's emissions exceed 250 tons/year of a single pollutant or emissions from a modification of a major stationary source exceed the significant amount. All Table 8.26 shows is that PSD de minimis concentrations may be exceeded and ambient air monitoring will probably be required in those cases. 23a-275

Page 8 - 103, paragraph 8.277: It is incorrect to include drilling rig emissions in an analysis of PSD ambient air 23a-276

increments since [illegible] rig emissions are temporary, and 40 CFR 51.24(f)(1)(iii) specifically excludes temporary emissions from being considered in an PSD increment consumption analysis. | 23a-276 cont

Page 8-10[illegible], Table 8-[illegible]. Drilling rig emissions should be omitted from this table, since they are temporary and therefore excluded from increment consumption [illegible]. | 23a-2[illegible]

Page 8-[illegible]09, paragraph [illegible] drilling rig emissions [illegible] ambient air increment consumption. The basis [illegible] should be stated. Drilling rigs are temporary sources [illegible] therefore excluded. They also are minor contributors of [illegible] emissions, the two pollutants for which increments exist. | 23a-278

Page 8-111, paragraph 8.292. The volume of [illegible] AND IMPACT are minimal. | 23a-279

Page 8-116, paragraph 8.305. "Related industry" should be identified. How is this discussion relevant to the CEIS ? | 23a-280

Page 8-133, Table 8-29. Change Mobile County, Mississippi to Mobile County, Alabama. | 23a-281

Pages 8-136, 137, Tables 8-32, 8-33. YEAR column is missing. | 23a-282

Page 8-138, paragraph 8.335: Potential State Revenues from Hydrocarbon Resource Development Offshore Alabama and Mississippi - Significant disregard of impact (nonstatement in narrative) of potential state revenues (pages [illegible]119 through 138 are devoted to employment analysis, as opposed to one paragraph and two tables for discussion of impacts of states' revenues. Also, escalators are assumed for employment analysis, why not for states' revenues ? What are the projected impacts on states' budgets, funding of public service programs, effects on future rates of income taxes, property taxes, and other taxes ? | 23a-283

23a-27[illegible]. See [illegible] comment 23a-276.

23a-27[illegible]. [illegible] comment 23a-276.

23a-279. Comment [illegible].

23a-280. [illegible] information was made available through confident[illegible] name be withheld. The information is presented in the [illegible] for comparison [illegible].

23a-281. Table 8-29 has been corrected.

23a-282. Table [illegible] have been corrected.

23a-283. Revenues [illegible] oil and gas resources are allocated [illegible] Alabama State General Fund (paragraph 3.23[illegible]) and are not allocated [illegible] budgets within the fund. Probable effects on [illegible] the state budget cannot be defined over the next 30 years since [illegible] appropriations [illegible] would also have a bearing on revenue generation. [illegible], however, that revenue collection would be enhanced [illegible] general effect would be beneficial to state and local governments [illegible] as a whole. A statement to this effect has been added to paragraph [illegible]. Additionally, [illegible] beneficial effect from monies generated by future [illegible] escalators, in the sense of providing for periodic [illegible] have not been assumed for employment. Rather, [illegible] employment [illegible] concurrent activities in a given year are depicted [illegible] potential effects that could result in any one year [illegible] with insufficient public services and infrastructure [illegible] the Economic Impact Assessment model for each year's employment [illegible] highly unlikely case does any immigration occur. The economic [illegible] population [illegible] determined via the model. [illegible] revenue [illegible] for any adverse effects, and since revenue spending [illegible] the state legislatures and on issues which change from [illegible] was taken of assessing the magnitude of possible revenues [illegible] resources as a whole.

Page 8-141, Table 8-36: **The projected number of plants seems excessive. Cite data, evidence** for the projected number of plants. 23a-284

Page 8-145, Table 8-39: Accident probabilities should be clearly stated in commonly-used lay terms. 23a-285

Page 9-1 through 9-4: Cumulative impacts - As presented, the reader cannot distinguish the **magnitude** of impacts and **incremental** increase of impacts between high-scenario oil/gas **activities and** projects **such as** navigation channel maintenance **and deepening, shell dredging,** shrimping, etc. In fact, **impacts are not even stated.** Chapter 9 **is merely a listing** of other **activities that may occur concurrently** with **oil/gas activities. In paragraph** 9.3, **what are the comparative,** quantitative impacts **of dredging** for channel **maintenance** versus dredging for access channels, canals **and barge slips** ? Similar quantitative **comparisons** should **be made** for **shell dredging** (paragraph 9.4), **shrimp** trawling (paragraph 9.5), logging operations (paragraph 9.6), and **all** other listed activities. 23a-286

Page 9-4, paragraph 9.?: **What** is the cumulative and comparable **impact** of wastewater discharge from the high-scenario resource **development,** versus the discharge of 20 million gallons per day **from the** proposed **Theodore wastewater** outfall ? 23a-287

Page 10-2, **paragraph** 10.8: **The** State Oil and Gas Board of **Alabama requires an emergency** plan for the accidental **release** of **hydrogen sulfide (Rule** 400-1-5-.02), but does not require the **other items specified in this paragraph.** 23a-288

Page 10-3, **paragraphs** 10.9, 10.10: **Inadequate discussion** of **industry practices. Safety system implementation, safety** record, **API RP-55 should be described in this section.** 23a-289

Page 10-4, **paragraph** 10.12: **Why was** Clean Gulf Associates not 23a-290

23a-284. Appendix ... contains ... the projections ... the estimates.

23a-285. The ... Table 8-39 ... the number of years ...

23a-286. Impacts of channel maintenance dredging ... wastewater disposal are included in the following environmental ... reference list: U.S. Army Corps of Engineers, 1973, ... Environmental Protection Agency, ... State of Alabama, and U.S. Army Corps ... that have been revised at paragraph ... and gas activities ...

23a-287. See response to comment ...

23a-288. The elements of an ... such a plan ... Engineers, ...

23a-289. Paragraphs ... practices but an introduction ... the Bibliography (see American Petroleum Institute ...) ... entry has been added to paragraph ...

23a-290. Clean Gulf Associates are referred ... 10.12.

Comment	No.	Response
listed ?		
Page 10-4, paragraph 10.14: Citation of U.S. Department of Interior, 1983a is incorrect.	23a-291	23a-291 The text has been revised to change the reference from "a" to "c".
Page 10-5, paragraph 10.14, last "o": Description of equipment necessary for offshore control is simplistic and incomplete. Describe "rubber bladder".	23a-292	23a-292. The types of equipment listed in paragraph 10.14 are based on information from Minerals Management Service. A rubber bladder is, from our understanding, a method for collecting oil from the water surface.
Page 10-5, paragraph 10.16: Cite documentation for first sentence.	23a-293	23a-293. Table 5-38 and 5-59 from Unterberg and Moorenead (1981) and U.S. Department of the Interior (1983c) respectively show that the number of accidents related to pipelines is high and, for the Gulf of Mexico, higher than for other types of spills. In addition, the U.S. Department of the Interior (1983c) Final Regional EIS states that "...more oil has been spilled from pipeline accidents than from other sources combined" (page 272). The text has been revised to include this reference.
Chapter 10 is incomplete and should be revised to accurately describe current industry practices.	23a-294	23a-294. Some revisions and additions to Chapter 10 have been made. See response to comments 23a-295 through 23a-304. A request was made to the Ad Hoc Committee of the Mid Continent Oil and Gas Association for additional information about industry practices but no information was received.
Page 10-4, paragraph 10.11: Why was no attempt made to analyze the economic viability of the mitigation measures listed ?	23a-295	23a-295 The category Other Potential Mitigating Practices is a list of many potential mitigating measures that could be utilized to reduce the potential environmental effects noted in the EIS. The discussion is not meant to imply that all listed items would be required or are necessarily feasible under all situations. The text has been revised to clarify this point.
Page 10-4, paragraph 10.12: MIRG should be discussed under Industry Practices, not under "Other Potential Mitigation Practices".	23a-296	23a-296. Paragraph 10.12 has been placed under "Industry Practice" and renumbered as Paragraph 10.11. Paragraph 10.11 has been renumbered as Paragraph 10.12. The discussion of MIRG in Appendix G is already included under "Industry Practice".
Page 10-7, Table 10-1: Use of trestle roads is not "Industry Practice". Sheetpile enclosures are designed and installed to prevent scour of foundation pad, not to control spills.	23a-297	23a-297. The use of trestle roads has been moved to the "Other" list and pad scour has been included. Sheetpiles are effective in mitigating small spills.
Page 10-7, Table 10-1: The inclusion, under Other Potential Mitigation Measures, of "no dredging allowed in the Bay/Sound for well-site access" is not warranted based on the projected impacts.	23a-298	23a-298. See response to comment 23a-295.
Page 10-8, Table 10-1: Joint ventures as described may not be feasible because of timing, diffferences in the quality of any	23a-299	23a-299. See response to comment 23a-295.

discovered [illegible] a[illegible]tors not considered in this study.

[illegible] "Source emissions" - In [illegible] required for nonattainment pollutants [illegible] and emissions in Mobile County) at a major source [illegible] precipitators, scrubbers, bag-houses, and [illegible] devices used by the [illegible] and gas production [illegible]. 23a-300

[illegible] The reference to 40 CFR 60.13 [illegible] applies to new source performance standards [illegible]

Page 10-[illegible], Table [illegible] Cite authority for requiring "delay or space at a more reasonable schedule". 23a-301

Page 10-11, Table [illegible] Cite references supporting the use of "inerting gas" in offshore environments, and the restriction of some equipment use to daylight hours. 23a-302

Page 10-15, Table 10-[illegible] Response unit is located in Bayou La Batre, not Bay St. Loui[illegible] 23a-303

Page 10-6, Table 10-1: Add response unit at Bayou La Batre. 23a-304

Page [illegible] Under the listing of potential long-term effects, biological effects due to habitat alteration, such as dredging of canals/slips and construction of pipelines in wetlands are included. If restoration is assumed, how can these be long-term impacts ? 23a-305

Page 12-[illegible], paragraph 2[illegible] The statement that a canal/slip "would result in the loss of biological productivity for 20-30 years" is incorrect and should be changed to "loss of some biological productivity" 23a-306

RESPONSE TO COMMENTS

23a-300. The text has been revised to delete references to LAER and CFR 60.13. Column four is intended to include measures not commonly used but that might have some applicability now or in the future.

23a-301. There is no authority implied. This is an <u>other potential</u> measure that the industry or regulators could consider. The Council on Environmental Quality (CEQ) requires that all potential mitigative measures be identified in an EIS as has been done in this Table, regardless of agency regulatory authority to implement it.

23a-302. See response to comment 23a-301.

23a-303. Table 10-1 has been changed.

23a-304. The Bayou La Batre response unit has been added to the spills and accidents section.

23a-305. The text has been revised to refer to loss of wetland area during the life of a productive field.

23a-306. [illegible] text has been revised to reflect this comment.

... paragraph ... The fifth objective of evaluating and ... environmental impacts has not been achieved in this draft. The pervasive, consistent lack of analysis of economic ... to the people of Alabama and Mississippi causes a bias that prevents the lay public from evaluating one of the most, ... the most significant environmental impact of the entire ... Other impacts should be consistently and clearly ... [illegible] | 23a-307

Page ..., paragraph ...: Change last objective to read: "Evaluate and display the SIGNIFICANT environmental impacts to the ... area based on the scenarios". | 23a-308

Page 13-..., paragraphs 13.2, 13.3: The assumptions of zero-discharge and site restoration eliminate the consideration of other, straightforward, commonly-practiced activities. This study, therefore, is incomplete. The GEIS should be revised to include all reasonable unit actions, and to remove the technical ...ities. | 23a-309

... paragraph ...: If an important purpose of this study is the expedition of permit requests, then Chapter 13 should mention ... how permit requests not included in the draft general permit would be expedited. | 23a-310

... Conclusions. Potentially Significant Impacts: This discussion does not "track" with Chapter 8 where cumulative impacts of unit actions and development scenarios are considered. First, "loss of natural resources" is a misnomer and should be ... throughout the GEIS. In terms of human generations, 20-... years would represent a temporary loss, not an irretrievable ... as stated. Restriction of fishing activities is not identified as significant elsewhere in the GEIS, why here? Evidence? Degradation of air quality likewise is not identified as a significant expectation in Chapter 8. Assumption of groundwater degradation is not warranted based on impacts | 23a-311

RESPONSE TO COMMENT

23a-307. See responses to comment 13.

23a-308. The objective of the EIS is to display all environmental impacts. As such no change to the statement is considered necessary.

23a-309. See response to comment 23-2.

23a-310. A discussion has been added to Chapter 13 explaining the permitting process and that the GEIS forms the backup for the General Permit recommendation and individual permit processing.

23a-311. Any activity associated with hydrocarbon exploration and production that results in an impact upon the listed environmental and socioeconomic factors is considered potentially significant dependent upon regulatory and industry controls on siting and operation activities and taking into consideration the possibility of accidents. All of the listed items and impacts are considered to be adequately addressed in the GEIS.

presented. [illegible] this paragraph should be documented, from the technical discussions in the GEIS, as to potentially significant impact.

Page 13-3, paragraph 13.5(c): The first two statements of this paragraph should be modified to state that potential exceedances of PSD increments and short term ambient air quality standards may occur if the highcase scenario occurs. The high scenario case models [illegible] emissions from 25 drilling rigs and six plants [illegible] operated in the study area during one year. [illegible] drilling rigs operating concurrently in one year, the [illegible] operators with leases in Mobile Bay would have to be running 25 rigs at once, a highly unlikely possibility. 23a-312

Page 13-3, paragraph 13.5(e): "Degradation of viewshed" is not discussed in the technical parts of the GEIS, and therefore its inclusion as a potentially significant impact is unwarranted. 23a-313

Page 13-4, paragraph 13.6.2: This is the first mention of air emissions from flares and refuse burning. The documentation for these minor impacts should be referenced. 23a-314

NEPA regulations do not provide for the presentation of minor impacts, as listed in paragraph 13.6. Another example of bias. 23a-315

Page 13-4, paragraph [illegible]: Provide documentation to support "public perception of [illegible] public health hazards ......". 23a-316

Page 13-5, paragraph 13.7. Mobile Delta excluded from consideration in the draft general permit because of "ecological sensitivity" and lack of specific data. In addition to this study that evaluates the environmental impacts of unit actions and cumulative effects of unit actions and resource scenarios in the Delta, the Mobile District COE, over the past 9 years, has studied, evaluated, and issued at least 8 permits for oil/gas activities in the Delta. An environmental impact statement was prepared for one of the permit applications, and two permits were issued for [illegible] and production, following proper 23a-317

RESPONSE TO COMMENTS

23a-312. The high case scenario is discussed in other parts of the EIS and it is not considered necessary to repeat it in Chapter 13. The estimate of 25 drilling rigs operating concurrently in one year was not dependent upon the number of operators with leases in the area but rather upon development of the resource.

23a-313. The EIS has been revised to better address degradation of viewshed.

23a-314. The text has been revised to delete reference to flares and refuse burning.

23a-315. The listing of minor impacts of concern is not considered to be a violation of NEPA nor an example of bias. It is, however, reflective of the cooperating agencies' perspection of the current circumstances and this is true of other parts of Chapter 13. As such, Chapter 13 has been appropriately retitled as "Interagency Perspective and Recommendations."

23a-316. As stated at the beginning of the paragraph these are items of concern and one item of concern to the cooperating agencies is public perception of potential health hazard due to transportation and disposal of drilling wastes in upland sites.

23a-317. See response to comment 23a-310. As discussed, the GEIS forms the overall environmental analysis foundation for future permit action evaluations. This is expected to aid in a more efficient permit applications evaluation process.

[illegible] evaluation to agency review, even if not included [illegible] permit [illegible] the GEIS should identify how [illegible] in the Delta would be exploited.

[illegible] The conclusion concerning a Finding [illegible] should be deleted from the GEIS. 23a-318

[illegible] The Recommended General Permit should [illegible] GEIS, however, because of its inclusion, [illegible] offered: Item 1. - Delete, because [illegible] sufficiently addressed in Item 8. Item 2. - [illegible] this condition, if adopted, would preclude [illegible] waters less than 8 feet deep. Furthermore, this [illegible] warranted by the projected environmental impacts [illegible] Chapter 4. Refer to comment for page 3-34, [illegible] Item 3. - Revise. The one mile offset of [illegible] from any shoreline is inconsistent with current [illegible] of the Alabama Department of Conservation and [illegible]. If Alabama requirements are incompatible with [illegible] of Mississippi, it is suggested that the permit be partitioned to accommodate both States' requirements. To date, permits have been issued for 5 wells that were drilled closer than one mile from shore with no discernable adverse impacts. [illegible] distances from oyster beds and grass beds should be [illegible] least reduced to acknowledge conditions and actual [illegible] these resources of existing and/or permitted [illegible] platforms and pipelines. Item 4. - Delete; this condition [illegible] by the GEIS. Item 5. - The U.S.C.G. does not require an oil-spill contingency plan, and this concern is adequately covered by Item 8. Item 7. - This condition should be revised to include the use of any clean, coarse aggregate to construct a foundation pad. Item 8. - Revise to: All State and Federal regulations and permits are met. List all appropriate regulatory agencies. Item 9. - Delete. The one-mile separation of a rig from any other structure is not consistent with existing state regulatory policy, and a technical interpretation of this requirement would eliminate drilling of multiple deviated wells from a common surface location, eliminate areas within one mile of aids-to-navigation and other similar structures, and would exclude a large portion of the study area from inclusion in the general permit. The State Oil and Gas Boards regulate well spacing, and it is common industry practice to minimize surface locations. Other water-dependent activities, such as shrimp trawling, occur compatibly in other coastal areas with much closer rig spacing than that proposed. Item 10. - Delete buffer requirement on "other navigation channels" or cite evidence or 23a-319

RESPONSE TO COMMENTS

23a-318. The statement is considered to be accurate and as such remains in the GEIS.

23a-319. All comments on the recommended General Permit have been taken into consideration and revised recommendations are reflected in the Final GEIS.

identified impacts which support restriction. Delete 500-foot buffer on pipelines, or cite precedence for requirement. Geohazard surveys submitted to the State Oil and Gas Boards would identify any existing hazards, including pipelines. Burial of the pipelines would afford protection against disturbance. Item 11. - Delete biological survey requirement. The DGEIS concluded that the impacts associated with installing a drilling rig were insignificant. The cultural resources survey requirement should be deleted. The cultural survey is not necessary, nor is it required in proposed 33 CFR Part 325 Appendix C (Federal Register, page 19017, May 4, 1984). Cultural resources are protected by General Condition II. d. Underwater Cultural Resources Surveys Performance Guidelines have never been published for public review. Items 12. and 13. These are unnecessary and redundant because the various regulatory agencies have already reviewed and approved the proposed permit. Please refer to various NPDES general permits, and COE general permits in other districts for form and content of other federal general permits. — 23a-319 cont.

Page 13-7, paragraph 13.11: Environmentally preferred alternatives in the Delta include activities that could jeopardize public safety (required directional drilling of rank wildcats) and minimize economic benefits to the people of Mississippi and Alabama. Item c. describes an alternative that has not been properly analyzed for prudent engineering feasibility, safety, cost to the industry, and ultimate cost to the people of Alabama and Mississippi. — 23a-320

Page 13-8, paragraph 13.12: Delete item 1.; avoidance of dredging in Bay/Sound is not justified by the GEIS. Delete Item 3.; the impact is temporary and not severe. Horizontal boring is not adequately analyzed in this study, and therefore should not be included in this category. — 23a-321

Page 13-9, paragraph 13.12.9: Based on the very conservative modeling, the requirement to avoid siting plants and rigs near urban industrial or Class I areas is excessive. This should be revised to state that sitings in these areas be evaluated closely. — 23a-322

Page 13-9, paragraph 13..3: What "significant adverse effects" have been identified in this study ? — 23a-323

RESPONSE TO COMMENTS

23a-320. As stated in paragraph 13.11, there is a lack of data for activities in the Delta. The cooperating agencies are currently in the process of formulating plans to initiate these additional studies. The first step will be a scoping process to identify information needs. Your group's technical expertise and assistance would be of benefit to these efforts.

23a-321. The items fall under the heading of environmentally preferred alternatives as a matter of information and recommendations from the cooperating agencies to the industry. Adverse environmental impacts can be associated with dredging depending upon the amount and location. This is addressed in the GEIS and reference documents. If avoidance of marsh or aquatic grassbeds is feasible it would be absolutely environmentally preferred to disturbance of the areas. Horizontal boring is recognized in the FGEIS.

23a-322. The statement is not a requirement but rather the environmentally preferred alternative at the generic level of evaluation. It is understood that each action would need to be evaluated based upon the specific situation.

23a-323. Environmental impacts are discussed in Chapters 4 through 9, 11 and 12. Chapter 13 represents the cooperating agencies perspective after considering the impacts discussed in the GEIS.

Page 15-1, paragraph 15.1. Why are the issued permits and studies within the Delta ignored? 23a-324

Page 15-3, paragraph 15.7. Clarify purpose of meeting held on February 22, 1981. It was requested by the MDCOE to describe the GEIS organization and the resource estimate. The meeting did not include or solicit industry comments on unit actions or development scenarios. 23a-325

COMMENTS ON APPENDICES TO DGEIS

APPENDIX A:

Page A-9, paragraph 2.2.1.1. Towing drafts for typical inland drilling barges do not average 4 to 5 feet, as stated. Most inland barges require 8 feet or more. 23a-326

Page A-10, paragraph 2.2.1.4: The design of the trestle road is not feasible for use in the Mobile Delta. 23a-327

Appendix E-3

Page E3-16, first paragraph:

PSD rules do not require evaluation of emissions from mobile sources [40 CFR 51.24(k) and 51.24(b)(18)]. This should be clearly stated. 23a-328

[illegible]

23a-324. Paragraph [illegible] has been [illegible] the Mobile Delta.

23a-325. Paragraph [illegible] has been [illegible].

23a-326. The text has been revised to [illegible] average seven or more feet. [illegible] Mobile Delta indicate towing [illegible] feet.

23a-327. The text has been modified [illegible] structural [illegible] could include structural steel, prestressed concrete, [illegible] as well as timber. [illegible] and trestle sections [illegible] north of the Mobile [illegible] drilling [illegible] South Louisiana was done using timber trestles and drilling platforms.

23a-328. The text has been revised [illegible] required [illegible].

Page E3-16, second paragraph:

The de minimis standard is actually the second screening level; the 250 ton/year limit is the first screening level to determine if PSD is applicable [40 CFR [illegible]]. The de minimis standard is used to determine if BACT and ambient air monitoring will be required. — 23a-329

Page E3-16, third paragraph

The de minimis concentration check is the third screening level. If modeling shows these concentrations are not exceeded, ambient air monitoring may be exempted. — 23a-330

Page E3-18, last paragraph

The basis for the .75 and [illegible] multipliers should be stated. — 23a-331

Page E3-27, Table [illegible]

footnote a - The basis for the 0.4 multiplier should be stated.

footnote b - The assumption that these 24-hour concentrations exceed the annual standard is grossly inaccurate. The assumption that this stability class and wind speed would continue for a year is wrong. The basis for the 10 multiplier should be stated. — 23a-332

Page E3-45 and 46:

This SO_2 modeling assumes that 25 drilling rigs will be operating concurrently in the study area. We do not believe this is plausible. — 23a-333

Page E3-56 and 57:

This NO_x modeling assumes that 25 drilling rigs will be operating concurrently in the study area. We do not believe this is plausible. — 23a-334

Appendix G-II

Page 2-19, Table 2-10.

The one hour photochemical oxidant NAAQS is 235 ug/m^3 [40 CFR 50.9]. — 23a-335

Page 2-29, Paragraph 2.2.1:

PSD rules specifically exclude mobile sources from the definition of secondary emissions [40 CFR 51.24(b)(18)]. Therefore, mobile sources should not be considered in this PSD evaluation. This comment applies throughout Appendix G-II. — 23a-336

Page 2-31, Paragraph 2.2.3.4:

The drilling rig emissions in Table 2-18 appear to be high side not "typical." Other rigs used in the area emit considerably less than what is shown in the table. — 23a-337

RESPONSE TO COMMENTS

23a-329. See response to comment 23a-269. This discussion is not following the PSD order of screening.

23a-330. See response to comments 23a-[illegible] and 23a-269

23a-331. These are the conversion factors for converting twenty-four hour concentrations to [illegible] hours and one hour respectively as recommended by EPA modeling guidelines.

23a-332. The conversion of 1-hour concentrations is simply done by multiplying the 1-hour value by 0.4 to determine the 24-hour concentrations in accordance with standard EPA modeling procedure and guidelines.

Footnote b - Turner suggests (and it has been modeled and found to be true many times) that when a first approximation of typical conditions for an area is required, D Stability and moderate wind speeds are [illegible] and concentrations at various distances out are solved for. The resultant concentrations are within ten percent of what one determines if one uses all the stability classes over an extended period time.

The factor of ten is a [illegible]. Dividing by ten, the 24-hour concentration can be converted to a conservative annual concentration. This method is often used by the Nuclear Regulatory Commission to determine a first approximation of annual concentrations quickly.

23a-333. Comment noted. This estimate was developed as a project standard.

23a-334. See response to comment 23a-333.

23a-335. The text has been revised to change 250 ug/m^3 to [illegible].

23a-336. See response to comment 23a-269

23a-337. The purpose of this study was to assess the impacts of [illegible] in this area in a reasonable and prudently conservative manner. [illegible] probably true, that other rigs may emit less than [illegible] have a [illegible] that probably others will not emit this much, but [illegible] has been permitted and presumably it can be again.

Page 2-36, Table 2-19

Either the CO or NO_x emissions are incorrect. Referring to AP-42 emission factors for diesel engines (Table 3 ...), CO emissions are 22% of NO_x emissions (3.03 gms CO/Bhp-hr : 14 gms NO_x/Bhp-hr). While CO emissions are 42% of NO_x emissions on this table. This comment applies as well to Table 2-26 (page 2-47) and Table 2-34 (page 2-55).

23a-338

23a-338. The CO, NO_x ... in fact, all of the emissions estimated from a review of the MOEPSI Air Quality Permit exercise. These were the permitted levels in the final analysis as a maximum for each controlled pollutant as far as emissions were concerned.

Page 2-48, first paragraph

We believe the agency means oil and/or condensate storage not "vapor storage."

23a-339

23a-339. See response to comment 23a-331.

Page 2-54, Paragraph 2.2.5.4:

The drilling rig emissions in Table 2-34 appear to be high side, not "typical." Other rigs used in the area emit considerably less than what is shown in the table.

23a-340

23a-340. See response to comment 23a-337.

Page 2-61, Paragraph 2.2.8.2:

Delete the statement on BACT and LAER since it is redundant. BACT is part of a PSD review and LAER is part of a nonattainment review. This paragraph is covered by the broad statement which requires compliance with all state and federal regulations (see the last paragraph on page 2-62).

23a-341

23a-341. Both of these represent possible mitigation measures.

Page 2-63, third paragraph:

Comments on page 8-94, paragraph 8.25 apply here also.

23a-342

23a-342. See response to comment 23a-268.

Page 2-64, Paragraph 2.3.2:

PSD rules exclude mobile sources from the definition of secondary emissions. This should be clearly stated.

23a-343

23a-343. See response to comments 23a-2?8 and 23a-272.

Page 2-64, Paragraph 2.3.2.1

Considering a very high side estimate of drilling rig emissions (25 rigs with maximum emission levels) was used, the second to last sentence should be qualified. This sentence should at least state that emissions are possibly exceeded for the high scenario case.

23a-344

23a-344. Comment noted. The text has been revised to reference the high scenario case.

Page 2-68, Paragraph 2.3.2.2.3:

In the discussion of NO_x results, it is quite conceivable that rigs could be placed closer than one mile apart since the modeling assumed worst case emissions. The GEIS should not ban siting of rigs closer than a mile, but should require a closer evaluation if rigs will be closely spaced. In the discussion of CO results the basis for 1.75 and 2.5 multiplier should be stated.

23a-345

23a-345. There is no way of knowing whether the permitted emissions of the MOEPSI rigs were worst case (upper limit) emissions. The purpose of the GEIS is to flag possible permitting problem areas, and since an already permitted project was used as our basis, it is conceivable that there might be permitting problems if rigs are spaced closer than one mile apart. The GEIS does not serve as a permitting exercise for all applicants and it was not intended to do so - only to indicate where problems might exist.

The conversion factors from 24-hour concentrations are standard practice items developed by EPA Guidelines Volume 10 is entitled "Guidelines for Air Quality Maintenance Planning and Analysis, Vol. 10 (Revised): Procedures for Evaluating Air Quality Impact of New Stationary Sources", R. Budney, EPA-450/4/4-77-00?, Oct. 19??.

[illegible] Page [illegible]

Page 2-[illegible]

The basis [illegible] and 2.5 multiplier should be stated. 23a-346

Page 2-[illegible], [illegible] to [illegible]

The basis for the 0.10 multiplier should be stated. 23a-347

Page [illegible], Paragraph 2.[illegible].4.1:

The [illegible] of the 100 kilometer limit for considering the impact of a source on [illegible] should be cited. It is generally understood that EPA [illegible] are only accurate up to a [illegible] distance. 23a-348

Page 2-5[illegible], [illegible]

[illegible] require an air quality permit regardless of the [illegible] Table 2-[illegible] only shows that based on preliminary modeling, monitoring of ground level concentrations of SO_2 will be required [illegible] even if located 10 kilometers apart. 23a-349

Page 2-8[illegible], Table 2-4[illegible]

In the footnotes, the basis for the 0.4 and 10 multipliers should be stated. This comment also applies to page 2-84 (Table 2-48), page 2-86 (Table 2-50), page 2-87 (Table 2-51), page 2-90 (Table 2-53), page 2-9[illegible] (Table 2-5[illegible]), page 2-93 (Table 2-56), page 2-94 (Table 2-57), page 2-97 (Table 2-59), page 2-98 (Table 2-60), page 2-101 (Table 2-62) and page 2-102 (Table 2-63). 23a-350

Page 2-88, Paragraph 2.3.5.3.3:

If a PSD permit is required for a new plant, it will be because emissions exceeded the 250 ton/year limit, not because the PSD de minimis concentrations are exceeded. 23a-351

Page 2-108, Figure 2-6:

ISCLT Modeling assumed 25 drilling rigs would be operating in the study area at one time. We believe this is an excessive assumption. 23a-352

RESPONSES TO COMMENTS

23a-346. See response to comment 23a-345.

23a-347. See response to comment 23a-3[illegible]2.

23a-348. See response to comment 23a-270.

23a-349. The text has been revised to include the possibility of ambient air quality monitoring for SO_2.

23a-350. See response to comment 23a-345.

23a-351. See response to comment 23a-275.

23a-352. See response to comment 23a-3[illegible].

- No Comment.

- No Comments.

This section shows that in most cases rig noise will attenuate to ambient before reaching shore because of distances involved, even if ambient levels are low (40 dBA). Rig noise, therefore, should not affect shore communities to any extent, even during night lapse conditions. 23a-353

Residences, especially Mobile Bay area, are sparse at the shoreline, and these are mostly seasonal vacation (3% or less of land) homes. 23a-354

- Shows that, due to wind & surf, ambient levels at Dauphin Island & Fort Morgan are above 50 dBA. A 90 dBA ambient facility would have to be within 2000' (approx.) for ambient levels at the shoreline to increase (attenuation distance). 23a-355

- No Comments

- No Comments

- Rig noise in a rural area in the marsh, inland, or offshore would attenuate to ambient levels radially within a short area. Unlikely human inhabitants within affected area. Wildlife in area of attenuation would be affected, but no more than by other drilling activities such as site prep, transportation, etc. 23a-356

3.2.2.1.2 - No Comments

3.2.2.1.3 thru 3.2.2.1.5 - No Comments

3.2.2.1.6 thru 3.2.2.4.2 - No Comments

- No Comments

3.2.4.1.1 - Assumes that "calm ambient" with no man-made noise may actually occur on areas such as Dauphin Island, and that rig noises on tracts close to shore may be above "calm ambient." In reality, "calm ambient" will rarely occur. Also the likelihood of enough rigs operating at one time in close enough proximity, to have cumulative noise effects on shore, especially during exploratory drilling, is extremely small. 23a-357

The statement that foghorns from rigs will be noticed is misleading since presumably shipping with louder than a rig's "class C" horn have passed through Mobile Bay channel for years.

RESPONSE TO COMMENTS

23a-353. Comment noted.

23a-354. Comment noted.

23a-355. Comment noted.

23a-356. Site preparation, particularly pile-driving operations, would produce the loudest noise (101dBA at 50 feet) and be the most obtrusive noise to any nearby humans and wildlife. However, it is the duration of rig operation, approximately 270 days for a recent Superior project, which would disrupt wildlife activities for extended periods. Perhaps this is the greater impact.

23a-357. "Calm ambient" noise levels are commonly exceeded on Dauphin Island by louder naturally occurring and manmade noise. Calm ambient noise levels will also be frequent depending, of course, on a receptor's location on the Island and weather conditions. See Section 3.3 of Appendix G for discussion of cumulative rig noise impacts.

MOGA ... [illegible] DGEIS Page [illegible]

3.2.4.1.2 - No Comment

3.2.4.2 - No Comments

3.2.5.2 - No Comments

3.2.5.3 - No Comments

3.2.5.4 No Comments

3.2.6 - No Comments

3.2.7.2 - Modern platforms and treatment facilities will probably be engineered and constructed to mitigate, as far as practicable, the noise levels of equipment. 23a-358

3.3.1 - [illegible] per tract simultaneously is excessive. [illegible] "set-back" policy of [illegible] mile, as far as noise is concerned, is excessive. 23a-359

3.3.2 - This section portrays the "possible" worst case scenario for noise. It is highly unlikely this "worst case" will ever occur. 23a-360

3.3.3 - No Comment

3.3.4.1.1 - Worst case for rig set-up at shoreline is 58 dBA - within the normal ambient range at Dauphin Island and Fort Morgan. 23a-361

3.3.4.2 - Worst case for rig normal operations at shoreline is 59 dBA - only 7dBA above low range of ambient levels at Dauphin Island. Rig crews sleep well offshore with steady-state noises in quarters of 60-65 dBA. 23a-362

3.4.1 - No Comments

3.4.2 - No Comments

3.4.3 - No Comments

3.4.4 - No Comments

RESPONSE TO COMMENTS

23a-358. Comment noted.

23a-359. The maximum rig density used in the noise analysis was used throughout the GEIS. The state established rig setbacks from coastlines were assumed for this analysis. Onshore noise impact may have been one factor considered by the states in establishing these setbacks.

23a-360. Comment noted.

23a-361. This does not assume rig set-up at the shoreline, rather it assumes the one mile offshore rig setback with the receptor at the beach.

23a-362. Comment noted.

COASTAL ALABAMA AND MISSISSIPPI GEIS
NOISE SUMMARY

... effects of ... Development Scenarios" ...

... about the same as existing ambient noise levels for continuous ... 23a-363

... significant

No Comments: Affected Environment

... that drilling activities in inland or marsh ... offshore ... activities ... human receptors ...

... effects of noise from rigs ... staging areas may be ... located in areas where ambient noise levels are already ...

... Coastal ... the Gulf of Mexico

Chapter 7 - Uplands

... Resource Development Scenario ... rigs clustered ... apart ... rigs 1.7 mile ... and noise level from this case ... to the shoreline ... activity is 59 dBA. This is close to ambient noise levels that ... Dauphin Island and Fort Morgan. 23a-366

... Cumulative Impacts

Chapter 10 - Mitigating Measures

Chapter 11 - No Comments

Chapter 12 - No Comments

Chapter 13 - Conclusions and Recommendations-noise impacts are not mentioned. 23a-367

RESPONSE TO COMMENTS

23a-363. Table 2-2 for noise impact is appropriate. Chapter 13 contains the conclusions of the GEIS. Noise is not identified as potentially significant.

23a-364. Comment noted.

23a-365. Comment noted. Staging areas are expected to be located in current industrial areas.

23a-366. Comment noted. See paragraph 8.73 of the GEIS.

23a-367. See response to comment 23a-363.

[illegible]

General Statement: This appendix, authored by the Environmental Protection Agency, represents a major portion of the DGEIS, and as such, Appendix G should have been given the same public distribution as were the main document and executive summary. Not only is Appendix G more clearly organized than the DGEIS, but it more clearly states, in lay terms, the projected environmental impacts to groundwater, air quality, noise, solid and hazardous wastes, and surface waters. 23a-368

More significantly, certain environmental conclusions displayed in Appendix G are inaccurately or incompletely stated in the main document. Since Appendix G is part of the DGEIS, these contradictions must be eliminated prior to publication of the FGEIS. 23a-369

Page G-42, paragraph [illegible].2.7: EPA considers the potential impact for the contamination of groundwater to be MINIMAL for the unit action analysis. This conclusion is not displayed in the various tables which predict groundwater contamination in all unit actions. 23a-370

Page G-57, paragraph [illegible].1.5: EPA states that the overall impact to groundwater resources cannot be adequately quantified, and yet the DGEIS projects the "certainty" of groundwater contamination from a variety of accidents. 23a-371

Page 2-61, paragraph 2.2.8.[illegible] In contrast to the nonstatement of air quality impacts in most of the tables within the DGEIS (only projected numeric values are displayed), this paragraph states, "There do not appear to be major significant negative impacts on 23a-372

23a-368. Comment noted.

23a-369. Comment noted. [illegible]

23a-370. The summary [illegible] is not [illegible]. The overall impact [illegible] resources from the geophysical exploration phase of hydrocarbon [illegible] considered minimal but only actions involving exploration drilling, [illegible] abandonment. These subsequent activities are considered to have [illegible] greater potential for significant impact to groundwater resources.

23a-371. [illegible] response to comment 23-6.

23a-372. Comment noted.

air quality from a singular unit action under normal activity. The rigs and unit actions do not cause sufficient air emission activity in any one area to warrant more than review and routine concern."

Page 2-113, paragraph 2.3.8: Even in the high-scenario analysis, EPA states that overall, the ambient air quality impact would be small. That conclusion is not apparent in the executive summary. 23a-373

Page 3-50, paragraph 3.2.7.1: Appendix G presents, in lay terms, the impact of various noise levels; the main document does not. 23a-374

Page 3-79, paragraph 3.3.5: An important conclusion that is understated or ignored in the main document: " The calculated noise levels presented in the scenario assessment are comparable to 1974 ambient levels of Dauphin Island...." 23a-375

Page 4-40, paragraph 4.1.3.4: This section contains a misleading and inaccurate statement that hazardous waste production would "continue to increase significantly." 23a-376

Page 5-220, paragraph 5.3.7: EPA states that most cumulative or potentially cumulative impacts to surface waters cannot be quantified. This conclusion is not apparent in the main document. With respect to the high-scenario case of 19 canals/slips in the Mobile Delta, EPA states that long-term accereration of existing erosion patterns is not anticipated, but the DGEIS in paragraph 8.12 states "The most widespread possible effects from so many canals would be changes in wetland erosion patterns." These and other contradictory statements must be reconciled. 23a-377

23a-373. The text has been revised to indicate that areawide air quality probably will not be significantly affected by projected hydrocarbon development with continuance of proper PSD review of new sources.

23a-374. Comment noted. This has been done to a limited extent in the main document by comparing unit action noise levels to more recognized activities' noise levels. What cannot be presented quantitatively is the aesthetic difference between a 59 dBA noise caused by a rig and a 59 dBA noise from the surf.

23a-375. Comment noted. Comparisons of rig generated noise impacts at an onshore receptor (Dauphin Island) with the ambient noise levels on Dauphin Island are presented in paragraph 5.99 of the main document.

23a-376. In context of the entire paragraph, this "significant increase" is mostly due to other than hydrocarbon wastes.

23a-377. The text has been revised to include the conclusion that impacts to surface waters cannot be quantified.

The statements about erosion patterns are not contradictory in the opinion of the EIS preparers. Section 5.3.7 in Appendix G states that long-term acceleration of erosion due to 19 canals and slips in the Mobile River Delta is not anticipated if available erosion control measures are implemented effectively. Paragraph 8.12 discusses possible effects under worst-case conditions which could be without erosion control measures. The word "would" in the second sentence of paragraph 8.12 has been changed to "could".

LETTER 24

Mid Continent Oil & Gas Association
Mississippi-Alabama Division

Suite 910 First National Bank Building P. O. Box 22925 Jackson, MS 39205 (601) 948-8903

James B. Furrh, Jr.
Chairman

Charles H. Williams, Jr.
President

June 25, 1984

District Engineer
U. S. Army Corps of Engineers, Mobile
Post Office Box 2288
Mobile, Alabama 36628

PUBLIC HEARING OF JUNE 14, 1984
CONCERNING THE DRAFT GENERIC
ENVIRONMENTAL IMPACT STATEMENT
FOR EXPLORATION AND PRODUCTION
OF HYDROCARBON RESOURCES IN
COASTAL ALABAMA AND MISSISSIPPI
AND THE DRAFT GENERAL PERMIT

Dear Sir

Mid-Continent Oil and Gas Association was encouraged by your statements during the referenced public hearing that the Final Generic Environmental Impact Statement would serve as the foundation and reference document for future permit requests for oil and gas exploration and production activities in coastal Alabama and Mississippi. This is consistent with your stated goal of expedited permit processing.

The general lack of public opposition to oil and gas activities within the study area is noteworthy. We believe there is a greater public awareness of the industry's worldwide safety record and more specifically of the absence of adverse environmental impacts from the 20 wells that are drilling or have been drilled in coastal Alabama.

In response to your extension of time for receiving comments on the DGEIS (June 28, 1984), the association has prepared additional comments on Appendix G. It is requested that the attached comments be fully and carefully considered in revising the DGEIS.

Very truly yours,

Glen Pike, for
Charles H. Williams, Jr.
President

Attachment

ADDITIONAL COMMENTS ON THE DRAFT GENERIC ENVIRONMENTAL IMPACT STATEMENT FOR EXPLORATION AND PRODUCTION OF HYDROCARBON RESOURCES IN COASTAL ALABAMA AND MISSISSIPPI, APRIL 1984 APPENDIX G

SUBMITTED BY

AD HOC TECHNICAL COMMITTEE
MID-CONTINENT OIL AND GAS ASSOCIATION

The following comments apply to the stated topics, some of which occur in more than one section of Appendix G.

API REFERENCES: Most quoted references to API publications refer to older or outdated editions. Current API publications (catalog attached) should be cited in the Final GEIS. 24-1

SOLID WASTE: Evidence should be cited to support the contention, on page 4-82, paragraph 4.3.1., that "several of the impacts addressed pose major environmental concerns...related to water quality issues." 24-2

SURFACE WATER CIRCULATION: In the discussion of the Mobile Delta, pages 5-76 through 5-97, and page 5-197, it is incorrectly stated that circulation is sluggish within the access canals, especially during periods of high water (approximately half of the time). 24-3

DREDGING IMPACTS: The incorrect assumption of irretrievable loss of wetlands should be revised to consider the restoration of environmental values (page 5-217). 24-4

RESPONSE TO COMMENTS

24-1. API references cited in the GEIS were those available at the time of preparation.

24-2. An example of this concept would be the volume of dredge material and its potential impacts on water quality (turbidity).

24-3. See response to comment 23a-29.

24-4. The loss of wetlands is evident and is considered long-term until a site restores itself following site abandonment. Some revisions to Appendix G (page 5-217) have been made.

The [illegible] to [illegible]9 canals/slips in the Delta [illegible] evidence to support statements that [illegible] patterns in the Delta could result from [illegible] 24-5

The assump[illegible] bank location would require less dredging [illegible] not necessarily correct. Many [illegible] be on natural levees of considerably [illegible] inland [illegible] swamp, and would [illegible] dredging of substantial volumes of [illegible] 24-6

The effects of turbidity created by dredging operations are greatly [illegible] this discussion should be revised to fairly eva[illegible] the temporary, local impacts of dredging. Similarly, [illegible] the section dealing with Mobile Bay and Mississippi Sound, a misleading discussion of the impacts of dredging associated with the oil and gas industry versus impacts of dredging associated with navigation channel maintenance and other projects needs revision (pages 5-97 through 5-106, and page 206). 24-7

PIPELINES: The assumption, and resulting projection of environmental impacts for open pipeline trenches in the Gulf of Mexico, are erroneous. Sediment transport in offshore areas does not allow pipeline trenches to remain open. 24-8

Impacts of pipelines crossing barrier islands should be analyzed, as should those associated with all actions normally performed by the oil and gas industry in other areas of the Gulf Coast. 24-9

DISPOSAL OF TREATED LIQUID WASTES: Incorrect statements concerning the disposal of certain treated wastes occur throughout Appendix G (e.g. pages 4-99, 108, 5-75, 200, 209, 214, 219). The U. S. Coast Guard and State regulatory agencies allow overboard discharge of treated bilge and ballast waters, and treated wastewaters. 24-10

HAZARDOUS WASTES: [illegible] page 4-80, paragraph 4.2.7., it is stated 24-11

RESPONSE TO COMMENTS

24-5. Actual impacts have been stated specifically as possible without knowing proposed well site locations. Changes in wetland erosion patterns could occur based on documentation of impacts from the Mississippi River-Delta (see p. 5-220), recognizing that wetland type, soil type, water velocities and effectiveness of mitigative measures greatly affect the amount of erosion that occurs. No text changes are warranted.

24-6. The text has been revised to include this possibility.

24-7. The EIS preparers do not consider the discussions of turbidity effects to be overstated. The text presents available information as quantitatively as is reasonable. No judgements about the significance of any of the impacts are included. Effects of dredging itself may be temporary, but the development resulting from the dredging is also discussed under routine operations. All comparable information about effects from other activities such as weather and shrimp trawling have been included; regrettably little information is available to quantitatively describe such impacts.

24-8. The text has been revised to indicate that impacts due to excavated trenches occur only for a short time until the trenches are refilled by natural forces.

24-9. The text has been revised to include a discussion of the effect of pipeline crossings of barrier islands. The assumptions underlying the analyses carried out in the EIS are given in the document.

24-10. See response to comment 23-10.

24-11. The text has been revised to clarify the concerns of processing wastes.

... significantly greater ... because their waste streams may include ... waste classified as hazardous. The extremely small ... may be ... represent a "significant ... concern", and this discussion should be revised to ... the impacts involved. 24-11 cont.

... the ... should be deleted. These refined ... not result from production activities. 24-12

PRODUCED WATER: The term "brine", within the Industry, ... refers to artificially prepared, salt-saturated ... and not to formation waters or produced waters of much ... salinity. 24-13

The statement describing the disposal of produced water is incorrect (page 4-53, paragraph ..., last sentence of ... paragraph). 24-14

REGULATORY PROGRAMS, REQUIREMENTS: The status of Class I wells ... should be updated (pages 1-11, 1-18, 1-37, 4-7). Incorrect statements are made concerning rules and regulations of the Alabama Oil and Gas Board, and should be deleted or revised ... (pages 1-36, 4-7, 4-7, 4-57, 4-64, 4-98, 5- ... 24-15

... statements of ... as industry practice on pages 4- ... are incorrect. The industry practice of zero- ... in the study area is a regulatory requirement and is ... other coastal areas. 24-16

... the potential of groundwater ... from ... drilling wastes (pages 1-37, 44, ... the statement in paragraph 24-17

RESPONSE TO COMMENTS

24-12. This is presented as background reference and relates to some of the additives that may be used during drilling.

24-13. The term "brine" has been used in other sources to describe the highly saline produced and formation waters associated with an oil well and that is the implied usage in the DOEIS.

24-14. An exact reference for this statement cannot be determined. The text has been revised to change "often" to "sometimes".

24-15. Although not clear in the comment, we believe the commenter is referring to permitting of new disposal wells. The text is correct in stating that ADEM is not permitting any new disposal wells (ADEM personal communication, 1984). We also believe that the discussions of the Alabama Oil and Gas Board rules/regulations are correct at this time. The text has been changed to indicate the Alabama Oil and Gas Board requirement for lined storage pits.

24-16. The statements in Chapter 4 of the Draft EIS Appendix C (pages 4-92 and 4-93) are not included under the industry practices section. On the other hand, we concur that the wording does not specify that the no-discharge requirement pertains to well sites and that the requirement is not a standard practice. The points have been specified in the last paragraph of Section 4.3.6 and the first paragraph of Section 4.4.1.

24-17. See response to comment 23g-266.

[illegible] threat to the area's sensitive groundwater [illegible] is posed." Impacts should be stated [illegible] statement "The potential exists for small hydrocarbon spills." (pages 4-50, 64). On page 4-60, impacts should [illegible] for possible minor spills. 24-17 cont.

Accident probabilities [illegible] be stated in commonly-used lay terms, not in exponen[illegible] Table 4-21, page 4-78, paragraph [illegible] associated with pipelines are used [illegible] Table [illegible]-36. 24-18

Table 5-36 is misleading, [illegible] to properly quantify potential [illegible] causes and relative [illegible] regarding [illegible] company, [illegible] a professional, scientific document [illegible] 24-19

ALTERNATIVES: [illegible] more thorough analysis of alternative methods, materials and equipment for oil and gas activities should be performed. Many of the described alternatives are not considered [illegible] feasible by experienced operators (e.g. trestle roads, [illegible] drilling rigs: pages 1-29, 4-43, 5-76 through [illegible] In fact, the "best case" alternative described on page 5-[illegible] the use of structures that are beyond the experience of the industry. An inaccurate statement concerning [illegible] (page 5-77) should be corrected. Certain alternative [illegible] described on page 1-65 are either nonexistent or [illegible] feasible (controlled horizontal fracturing, use of polymers as described). 24-20

WORKOVER OPERATIONS: Well workover is performed not only to [illegible] production, but may be required when changing productive zones, and for mechanical repair (page 1-31). 24-21

ENHANCED RECOVERY: Discussions concerning enhanced recovery should be qualified to indicate that the study area is gas-prone 24-22

RESPONSE TO COMMENTS

24-18. Oil spills could impact shallow aquifers along the coast and on the islands in Mobile Bay. These aquifers, in some cases, are already stressed by saltwater intrusion and wastewater disposal. Pollution from oil spills leachate could render additional fresh groundwater sources unfit for use.

24-19. The relative frequencies of spills presented in Table 5-36 are not probabilities; rather, the numbers are based on past operations in the Gulf of Mexico largely since 1967. The relative frequencies and potential spill sizes are based on actual Gulf operations. Two revisions have been made in Table 5-36 under rig/platform to specify that intentional discharges have occurred and to specify that the mud disposal practices pertain to offshore federal waters. The text has been revised to eliminate the bias of this paragraph.

24-20. The text has been revised to remove reference to lightweight drilling rigs. A trestle road for access to a floodplain drilling site on the Tombigbee River was recently proposed. The statement on directional drilling has not been changed because no information is provided in the comment as to what the inaccuracy is. The technologies described on page 1-65 are not presented as a current industry practice but rather an "alternative" technology that may or may not yet be fully proven.

24-21. The text has been revised to expand the requirements for well workover.

24-22. The text has been revised to indicate that most of the study area is gas-prone and many enhanced recovery techniques are not applicable.

Comment		Response
[illegible] enhanced recovery techniques. [illegible] techniques would be limited and [illegible] environmental [illegible] (pages 1-31,	24-22 cont.	
[illegible] IMPROPER PLUGGING [illegible] throughout Appendix [illegible] these statements would be limited, [illegible] the real potential of [illegible] operations. [illegible] required, would [illegible] through the surface [illegible] implies. Groundwater would be isolated from [illegible] by several intact casing strings and [illegible] Furthermore, fracturing would be performed within [illegible] (11,000 to 23,000 feet), over 12,000 feet [illegible] bearing aquifers. Because of the lithology [illegible] fracturing would have limited [illegible] Refer to pages 1-3?, 1-39, 1-44, 1-46, [illegible] The fracturing process is hydraulic (no [illegible] as indicated on page 1-33), and there is no [illegible] evidence [illegible] the study area to support the notion of [illegible] contamination by losing "large amounts of drilling [illegible] or cavernous aquifer" (page 1-3?). [illegible] discussion of groundwater contamination is misleading [illegible] empirical data cited in the DEIS (ATS study [illegible] quality in the Citronelle Oil Field).	24-23	24-23. The text has been revised where appropriate to qualify potential groundwater impacts from enhancement procedures.
[illegible] on page 1-45 that pollution potential is not [illegible] for groundwater resources. What, then, is the basis [illegible] elsewhere in Appendix G that assume accidents and [illegible] contamination of area groundwater resources ? (Pages 1-33, 1-34, 1-38, 1-39, 1-4?, 1-44, 1-46, 1-48, 1-51, 1-57, 1-60,	24-24	24-24. See response to comment 23a-371.
The assumption of improperly plugged and abandoned wells and casing rupture is archaic and does not recognize the modern [illegible] of the oil and gas industry (pages 1-33, 1-61).	24-25	24-25. Comment noted.
Recently observed chloride contamination of certain shallow water [illegible] the coastal area of Alabama may be related to [illegible] and water table changes produced by Hurricane [illegible] and/or to increased withdrawal of area groundwaters [illegible] assumed chloride contamination from injection of	24-26	24-26. Comment noted.

RESPONSE TO COMMENTS

produced waters (pages 1-41, 1-46, 1-48 1-57, 1-60, 1-61) is simply not warranted based on empirical data from the study area. 24-26 cont.

DIRECTIONAL DRILLING: Paragraph 5.2.2.2, page 5-77, states: "Directional drilling could only reach hydrocarbons beneath the patron (sic) of the delta within approximately 3,500 lateral feet of the upland drilling site." This statement, as well as all others dealing with the technique of directional drilling (page 5-243) is misleading and incorrect. Depending on the projected depth of the well, stratigraphic and structural conditions, geopressure projections, and previous drilling experience in the immediate area, operators may elect to directionally drill certain wells, but the amount of feasible offset may be much less than the values quoted here and throughout the GEIS. Directional wells require more time to drill, produce more drilling wastes, are more difficult to drill, and cost more than do vertical wells. The assumption that directional drilling to depths of 17,000 - 23,000 feet is common industry practice is simply untrue. Many shallow wells have been directionally drilled, especially in proven fields, but deep directional wells are exceptionally rare. 24-27

MITIGATIVE MEASURES: The State Oil and Gas Board of Alabama requires an emergency plan for the accidental release of hydrogen sulfide (Rule 400-1-5-.02), but does not require the other items specified on page 5-234. The State Oil and Gas Boards do not control leasing of state tracts (page 5-237). It is stated, on page 5-242, that developers of canals and slips in the Mobile River Delta have implemented "guarantees that certain percentages of organisms will survive hydrocarbon site development activities." Please cite documentation to support this statement. 24-28

RESPONSE TO COMMENT

24-27. The value of 3,500 lateral feet is a maximum lateral distance into the delta which a directionally drilled hole can extend from an upland site, based on a 17,000 foot vertical depth and a 10-degree directional angle (tan 10° approximately [illegible]). We agree that the lateral distance is usually much less, hence we used the conditional tense ("could"). The paragraph does not imply that a 3,500-foot lateral [illegible] common industry practice. The text has been revised to clarify this point.

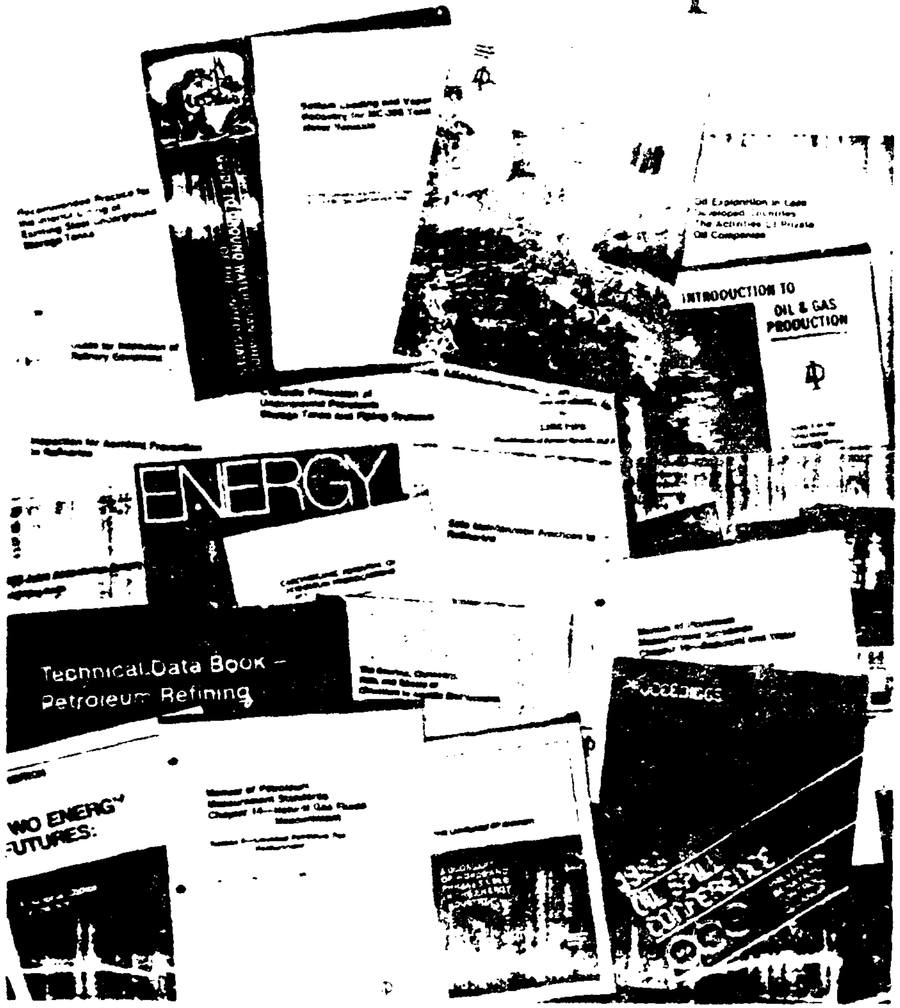
24-28. The emergency action plan disussed on page 5-234 of Appendix G was developed by Mobil Oil Corporation, according to U.S. Army Corps of Engineers [illegible]. [illegible] revisions have been made.

The last two sentences in the first paragraph on page 5-237 have been deleted.

The idea of a voluntary guarantee that certain percentages of organisms [illegible] survive hydrocarbon development activities is based on information obtained from [illegible] Oil during 1983 for development in the Mobile River Delta. [illegible] of planted trees.

Publications And Materials 1984

American Petroleum Institute



LETTER 25

Getty

Getty Oil Company | Post Office Box 1404 Houston Texas 77001 Telephone (713) 651 5000

Judd H. Dualine Vice President and General Manager
Southern Exploration and Production Division

June 14, 1984

District Engineer
U.S. Army Corps of Engineers
Mobile District
P. O. Box 2288
Mobile AL 36628

Attention: SAMOP-S

Re: Comments on Draft Generic EIS for Exploration and Production of Hydrocarbon Resources, and Proposed General Permit MD001 for Hydrocarbon Exploratory/Appraisal Drilling Activities in Coastal Alabama and Mississippi.

Dear Sir:

Getty Oil Company does not currently have any leasehold interests in the study area. However, we have a number of blocks in the OCS adjacent to Alabama state waters. Company representatives have participated in the Mid-Continent Oil and Gas Association (MCOGA) review of the draft permit and the DGEIS since the public policy set in these documents could significantly affect our plans for OCS development and bidding on any Alabama or Mississippi state waters acreage. Getty supports the industry position presented by MCOGA.

Comments -- Draft General Permit Conditions

Getty, like many other companies, is considering bidding on acreage in state waters in the upcoming Alabama lease sale in August. The company would like the assurance that the potentially lengthy process for adoption of a general permit for exploration and delineation drilling would in no way hinder individual permitting for new wells on leases issued in August of this year. 25-1

Much of the available acreage in Alabama state waters is in shallow areas of the sound and bay. For this reason, we feel that the draft general permit should allow minimal amounts of dredging to reach drilling sites in water depths of five to six feet. We believe that the data and analysis presented and demonstrated by the draft GEIS, would not adversely impact the aquatic ecosystem and would increase the options available to successful bidders. 25-2

RESPONSE TO COMMENTS

25-1. Individual permit applications will continue to be processed as usual with the exception that more of the GEIS provides basic backup information to make the process proceed more efficiently. Only information necessary to [illegible] the Generic environmental ananlysis would be requested from the applicant.

25-2. The impacts from dredging would be dependent upon the location and amount of dredging associated with a specific proposed action. This is why dredging was not allowed under the proposed General Permit. However, the companies have the option to seek an individual permit if their activity includes dredging.

June 14
Page 2

The only alternative for exploration drilling on many of these potential leases would be directional [illegible] Getty's experience with directional drilling in Alabama [illegible] similar geologic [illegible] indicates that this can be an extremely expensive and some [illegible] hazardous alternative.

Further, Getty believes that [illegible] state law [illegible] govern all operations, particularly in the [illegible] of the [illegible] discharge provision. If the required permits for discharges of rainwater and ballast water are obtained from the appropriate state agencies, then the general permit from the Corps should allow them as well. 25-3

We urge you to consider these and MOGA's comments and make appropriate modifications to the conditions of the proposed general permit.

Comments on Draft Generic Environmental Impact Statement

In many instances, the writers of the draft document assume that the industry will conduct joint activities. Getty believes that such assumptions are not always valid in practice and that in fact joint activities may be illegal from an antitrust standpoint. As an operator in the OCS, Getty would not want to be "forced" into a joint operating situation by a public [illegible] document such as the GEIS. For example, pipeline routing and plant location options should be left to individual operators [illegible], based on specific development conditions. 25-4

One of the alternatives for pipeline routing that was not considered was the barrier island crossing. As [illegible] of OCS leases, Getty Oil Company may be bringing hydrocarbons to a processing plant on land. Given the proper set of circumstances, the most direct and environmentally [illegible] route could be across a barrier island. We urge you to consider this situation in the GEIS. 25-5

The DGEIS does not address alternatives to "no discharge." Discharge options should be considered an alternative, since other disposal methods have the potential for increasing costs by tens of millions of dollars over the life of a lease [illegible] In order to adequately balance economic and environmental concerns, discharge options should be considered as a reasonable alternative. 25-6

25-3. As noted in response to similar comments [illegible] the GEIS was written based upon the assumption of no discharge [illegible] in accordance [illegible] As [illegible] the proposed General Permit has this condition. However, the companies may seek an individual permit from the Corps of Engineers if their activity includes discharge of pollutants.

25-4. The Mobile District recognizes the many constraints on the use of the joint activities in developing the hydrocarbon resources within the study area. The resource development scenarios developed and used in Chapter 4 of the [illegible] have assumed standard industry practices for that undertaking. An [illegible] document but an environmental information source document to inform the [illegible] the decision makers. Decisions on granting permits for proposed activities to develop hydrocarbon resources would be based on many factors, including environmental ones.

25-5. An analysis of pipeline crossings of barrier islands has been added to the final EIS.

25-6. The GEIS was written based upon assumptions [illegible] time. If [illegible] are proposed outside of these assumptions then the [illegible] app[illegible] individual permit and additional environmental [illegible] would be [illegible] depending upon the specifics of the permit application.

June [illegible]
Page [illegible]

[illegible] Oil Company will continue to work closely with [illegible] Staff on these issues. We appreciate the [illegible] comments.

Sincerely,

Judd H. Qualline

LETTER 26

PHILLIPS PETROLEUM COMPANY

[illegible]

BELLAIRE, TEXAS
6330 WEST LOOP SOUTH
PHILLIPS BUILDING

[illegible] 1984

[illegible] Engineer
[illegible] Army Corps of Engineers, Mobile
[illegible] Box [illegible]
[illegible]

Re: Comments on Draft Generic Environmental Impact
Statement [illegible] and proposed General Permit MOG02

Dear [illegible]:

Phillips Petroleum Company has participated in the joint industry review of the [illegible] and the proposed general permit by the Mid Continent Oil & Gas Association, and we are supportive of the recommendations and suggestions presented by that group for revision of these documents. However, since each company in that group has a unique set of lease and operational circumstances, we would like to respond separately to a number of issues presented in the [illegible] that are specific to Phillips Petroleum Company's operations. We are [illegible] making comments and suggestions on the proposed general permit.

BACKGROUND

As you will recall, Phillips Petroleum Company along with two bidding partners was the successful bidder for Alabama State Lease 529, Tract 89, off the west end of Dauphin Island. Tract 89 encompasses acreage in both Mississippi Sound and the Gulf of Mexico. Alabama State Lease No. 529 was issued to Phillips, Hunt Oil Company [illegible] Sohio Petroleum on April 2, 1981, for a total bonus of $4[illegible] million, [illegible] royalty interest, and a primary term of five years. The lease [illegible] the important stipulation that "no drilling is permitted within one-half [illegible] of [illegible] line of any land area."

Phillips filed application for three well locations on the tract early in May 1981 and was a participant in all subsequent hearings, meetings and [illegible] deliberations. In late 1982, Phillips put its permitting effort on [illegible] hold and entered into a joint agreement with Mobil and Union to participate in an exploratory well in the southwest corner of Tract 72 less than one-mile from the north shore of Dauphin Island on a drilling unit that included acreage from State Lease 529. That well produced a significant natural gas discovery. Phillips is now reactivating the permitting process [illegible] the wells originally proposed. These three wells, one in Mississippi Sound and two in the Gulf of Mexico, will be drilled to delineate the new [illegible] 72 field.

SPECIFIC COMMENTS ON DGEIS

Assumption of "zero discharge" for all future activities

Phillips believes that discharges of non-contact cooling water, deck drainage, fire pump test water, ballast water and any other source that meets state water quality standards should be considered as one of the alternatives for future activities. This is particularly true for State Lease 529 since the environmental setting for our wells in the Gulf of Mexico is in 25-30' water depths and in a relatively high-energy current regime. We would strongly urge that the zero discharge assumption for the GDEIS analysis be revised to include an alternative for discharges, particularly if the discharge area is in the Gulf of Mexico. 26-1

Further, the DGEIS document should be used as the applicable forum to discuss a technical program to allow discharges in certain cases. A monitoring and assessment program could be used to document the fate and effects of discharged fluids and cuttings. Phillips considers the multimillion dollar expenditure per well for waste disposal a significant economic impact that should be weighed against the adversity of environmental impacts, particularly if only minor environmental impacts of short duration are anticipated. 26-2

Phillips, and I am sure other lessees and potential bidders of state leases in Alabama and Mississippi state waters, would like to know that modifications to the "zero discharge" policy are being addressed.

Pipeline routing through environmentally sensitive areas

One of the alternatives for pipeline routes that was not considered in the DGEIS was barrier island crossings that would have minor impacts on wetlands, grassbeds, and oyster beds. Phillips considers this to be a reasonable alternative that should be considered. 26-3

SPECIFIC COMMENTS ON DRAFT GENERAL PERMIT

The concept of a general permit for routine operations where environmental impacts have been demonstrated to be minor is good, provided that there is a savings in time and money to the agency and applicant alike. General permits are intended for routine operations where environmental impacts have been demonstrated to be minor. In our opinion, the proposed permit in its present form with the long list of proposed restrictive conditions will not significantly "streamline" the process for either party. The numerous restrictive conditions will eliminate much of the leased acreage from inclusion in the general permit. In our opinion the finding of the DGEIS do no indicate the need for these restrictive conditions. 26-4

Recommended changes

Provisions of existing state and federal law should govern a general permit; a general permit should not provide conditions more stringent than the applicable law or rule allows. Phillips Petroleum Company strongly recommends that the proposed general permit conditions be reworded to allow for the rules of the agency of record to apply. Specifically, the provisions of

RESPONSE TO COMMENTS

26-1. The EIS is based on the current policies of the states of Alabama and Mississippi. Should the policy change in the future, a supplement to the EIS could be prepared.

26-2. Comment noted. An EIS is prepared as an information source for the general public and governmental action decision makers. The purpose is to determine to the extent possible the environmental consequences of proposed activities given current knowledge. Because of this, research or monitoring programs are usually not part of the EIS process, but may be undertaken as a result of the EIS process if it is determined from review of the EIS that insufficient data are available for adequate decision making regarding certain issues.

26-3. A discussion of the effects of pipeline crossings of barrier islands has been added to the EIS.

26-4. The comments will be taken into consideration as a part of decisions pertinent to finalization of the General Permit. Also see responses to comments 25-3 and 25-6.

[illegible] and
[illegible] and we believe
[illegible] State [illegible] and Gas Board
[illegible] meet [illegible] discharge standards for
[illegible] Environmental Management agrees, then the
[illegible] such

[illegible] environmentally significant areas
[illegible] dredging. There a number
[illegible] Dauphin Island on Tract 89 where
[illegible] the environmentally
[illegible] location. We recommend
[illegible] dredging (with possible
[illegible]

[illegible] continue to work with you and your [illegible]
[illegible] these matters.

LETTER 27

ARCO Oil and Gas Company
South Louisiana District
Post Office Box 51408, Oil Center Station
Lafayette, Louisiana 70505
Telephone 318 264 4000

Donald E. Jessup
Vice President

June 14, 1984

District Engineer
U.S. Army Corps of Engineers, Mobile
Post Office Box 2288
Mobile, Alabama 36628

Re: Draft Generic Environmental Impact Statement and Proposed General Permit for Coastal Mississippi and Alabama

Dear Sir:

ARCO Oil and Gas Company (AOGC) and ARCO Exploration Company (AEX), divisions of Atlantic Richfield Company, would like to take this opportunity to comment on the Draft Generic Environmental Impact Statement (DGEIS) and Proposed General Permit for coastal Mississippi and Alabama. We have been intimately involved in the review of these documents through our participation in the Mid Continent Oil and Gas Association (Alabama/Mississippi Division) Review Committee and strongly support their comments and recommendations. We are concerned both as an industry member and as a leaseholder in the study area.

We urge you to accept those recommendations as submitted by Mid Continent, in particular:

27-1

1. To include the Mobile Delta in the General Permit.
2. Address development/production activities in the General Permit.
3. Delete the <u>no dredging</u> restriction in the General Permit.
4. Be consistent with the states requirements, particularly in regard to buffer zones.

RESPONSE TO COMMENTS

27-1. The comments will be taken into consideration for further processing of the proposed General Permit. Revisions to the proposed General Permit are contained in Chapter 23 of FGEIS. Also see responses to comments 20-1, 20-2, and 23-2. No supplement to the GEIS is considered necessary at this time.

5. Supplement the GEIS with an analysis of reasonable alternatives to no discharge, complete site restoration and no construction activities in "sensitive" areas as required by the National Environmental Policy Act (NEPA). 27-1 cont.

We wish to thank the Corps of Engineers and the entire Executive Committee in advance for their consideration of these comments. Through our efforts with Mid Con ment we are available to assist the Corps to p ide a complete final document.

Sincerely,

ARCO Oil and Gas Company

Donald E. Jessup

Donald E. Jessup

EPD/clh/u

LETTER 28

Mobil Oil Exploration & Producing Southeast Inc.

June 14, 1984

District Engineer
U. S. Army Corps of Engineers, Mobile
P. O. Box 2288
Mobile, Alabama 36628

(1) DRAFT GENERIC ENVIRONMENTAL IMPACT STATEMENT ("GEIS"): HYDROCARBON EXPLORATION AND PRODUCTION IN COASTAL ALABAMA AND MISSISSIPPI
(2) PROPOSED GENERAL PERMIT FOR HYDROCARBON EXPLORATION AND APPRAISAL DRILLING ACTIVITIES

Dear Sir:

Mobil Oil Exploration & Producing Southeast Inc. ("MOEPSI") has expressed continuing strong interest in a comprehensive GEIS and accompanying general permit for hydrocarbon exploration and production activities in Alabama coastal waters.

More than any other company, MOEPSI has experienced the problems and delays in securing individual permits for exploration and production activities in Alabama coastal waters. MOEPSI's past permit requests have precipitated three separate environmental impact statements and a very lengthy environmental assessment.

Therefore, MOEPSI is pleased that the Mobile District Corps of Engineers has undertaken such GEIS and general permit preparation and appreciates the opportunity to comment on the subject documents. This letter containing MOEPSI's comments is submitted for inclusion in the official record of the June 14, 1984 public hearing, GEIS correspondence file and general permit coordination file MDGO2.

MOEPSI has co-chaired the GEIS industry review committee formed under Mid-Continent Oil and Gas Association (Mississippi/Alabama Division), and fully supports the Mid-Continent views expressed in

Mobil

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its attached written comments and in its oral comments at the June 14, 1984 public hearing -- both as to the draft GEIS and the proposed general permit.

As to the Proposed General Permit:

Of particular concern is the proposed permit prohibition against any rig location closer than one mile to any shoreline or oyster reef or to any other rig, platform, wellhead or other structure. The one-mile-from-another-structure restriction, for example, would prohibit drilling more than one well from a single site or platform -- a restriction neither economically efficient nor environmentally sound. With this restriction as now written, MOEPSI cannot support the proposed general permit.

This restriction -- and the other drill site restrictions discussed by Mid-Continent: 28-1

(1) Are inconsistent with the findings of the GEIS;

(2) Are more restrictive than conditions in recently issued individual COE permits for exploration and production activities in Alabama coastal waters;

(3) Are not consistent with current policy of the State of Alabama; and

(4) Would do little to expedite current individual permit procedures, despite the fact that streamlining the permitting process is the heart of the whole GEIS and general permit concept.

MOEPSI therefore strongly urges the restrictions on the proposed general permit be modified or deleted, as recommended by Mid-Continent -- without which the proposed general permit would have extremely limited value.

As to the Draft GEIS:

MOEPSI believes, for reasons more fully set out by Mid-Continent, the GEIS needs in-depth analysis of reasonable alternatives to three basic assumptions made therein: (1) zero discharge, (2) restoration of canals and barge slips and (3) no activity in or through certain areas, in order to assure its fully meeting National Environmental Policy Act (NEPA) requirements. In 28-2

28-1. Comments on the recommended proposed General Permit conditions have been taken into consideration and revised recommendations are now contained in Chapter of the FGEIS. They will be further considered along with any additional comments in the final decision as to whether or not to issue the General Permit. Also see response to Mid-Continent Oil and Gas Association.

28-2. As stated, these comments are more detailed in the Mid-Continent letter of comment. As such, please refer to responses to the Mid-Continent letter, in particular comments 23-2, 23-11, and 23a-3.

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May
... 13, 1984

... should be revised to concisely discuss environmental ... in proportion to their significance -- important for NEPA and obtaining the result of a more clearly focused and ... shorter document. 28-2 cont.

... your attention to the following draft GEIS references ... existing permits, plans and/or operations which need ...

(1) Page 1-2, paragraph 1.5 - commercial production from the Lower Mobile Bay-Mary Ann Field is not expected to commence prior to late 1986. 28-3

(2) Page 3-107, paragraph 3.249 - MOEPSI is not aware of any identified conflicts in dock space between its operations and the commercial fishing industry in Bayou La Batre. To the contrary, MOEPSI's presence in Bayou La Batre has been very amicable, and MOEPSI considers itself a well received corporate citizen of that community. 28-4

(3) Page 4-15 table 4-3 - the emission rate for CO stated in the table is four times the single rig CO emission rate contained in MOEPSI's 1981 PSD application. 28-5

(4) Page 4-27, table 4-4 - the 76-1 well drilling mud for which heavy metal constituents are shown on table 4-4 was not a typical drilling mud. This table and paragraph 4.86 are reminiscent of discussions on this same subject which took place during the writing of the FIS for development and production of the Lower Mobile Bay-Mary Ann Field. (Production of Natural Gas from the Lower Mobile Bay Field, Alabama FEIS, U.S. Corps of Engineers Mobile District May 1982.) It is recommended that paragraphs 4.33 through 4.37 of the referenced 1982 EIS be reviewed. Subsequent to this review, table 4-4 and paragraph 4.86 of the GEIS should be properly revised to reflect a typical drilling mud. 28-6

(5) Page 4-96, paragraph 4.314 - in its 1981 PSD application MOEPSI did not address H_2S concentrations resulting from blowouts. Blowouts and resulting H_2S concentrations are addressed in contingency plans submitted to the Alabama Oil and Gas Board, not in PSD applications. 28-7

RESPONSE TO COMMENTS

28-3. The text of paragraph 1.5 has been changed to indicate the expected date of commercial production. Note: The corrected text is attached to comment 23a-12.

28-4. The text of paragraph 3.249 has been corrected.

28-5. See response to comment 23a-84.

28-6. The text has been revised to delete Table 4-4 and its counterpart in Appendix G.

28-7. Comment noted. The term "PSD" in the second sentence found on page 4-86 has been deleted.

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(6) Page 5-20, paragraph 5.64 - the settlement agreement mentioned in paragraph 5.64 should be specified. As written it appears to refer to the agreement entered into in March 1978 for drilling of well 76-1. The paragraph is incorrect as this agreement applied specifically to this individual well. It was later amended in September 1980 to specifically apply to four appraisal wells in the Lower Mobile Bay-Mary Ann Field. More recent letters of commitment, which apply broadly to all current drilling operations, establish the policy in Alabama to be somewhat relaxed from the 1978 Mobil settlement, in that discharges of uncontaminated rainwater, uncontaminated deck drainage, uncontaminated ballast and preload water, and non contract cooling water are authorized. 28-8

MOEPSI remains very much interested in a comprehensive GEIS that clearly satisfies NEPA requirements, and in a general permit that truly expedites authorization of exploration and production activities in Alabama and Mississippi coastal waters. We are willing to work with you to try to make the subject documents meet these objectives.

Very truly yours,

C. E. Spruell

C. E. Spruell
President

/mm
OGC32159

RESPONSE TO COMMENTS

28-8. Comment noted. Text indicates this discussion is based on the settlement agreement with Mobil Oil. Subsequent agreements between the State of Alabama and drilling applicants for projects in the Bay are somewhat different and do allow certain discharges.

LETTER 29

Conoco Inc.
P.O. Box 51266
Lafayette, LA 70505
(318) 237-3800

Frank R. Bello
Division Manager
Lafayette Division
North American Production

June 14, 1984

District Engineer
U. S. Army Corps of Engineers
Mobile District
P. O. Box 2288
Mobile, AL 36628

Gentlemen:

Subject: Public Notice No. MDG02

The Lafayette Division, North American Production, Conoco Inc., wholly owned subsidiary of Conoco Delaware Inc., is pleased to have the opportunity to submit written comments on the Draft Generic Environmental Impact Statement for Hydrocarbon Exploration and Production Activities in Alabama and Mississippi Coastal Areas Related to the Corps Permitting Program (GEIS) and the proposed General Permit.

The Lafayette Division has been active in the Technical Committee sponsored by the Mississippi-Alabama Division of the Mid-Continent Oil and Gas Association (MOGA) and generally supports the comments of the committee as provided to the Corps by MOGA on the GEIS and General Permit.

We do wish to emphasize our concerns on the following points:

1. The exclusion of the Delta from the General Permit and the lack of provision for production activities in the General Permit.

   Discussion. We applaud the Corps and the contributing agencies in making this first important step toward unencumbering the permitting process. We do believe that the GEIS is adequate in depth, in so far as potential negative impact, to provide a basis for inclusion of the Delta and for provisions for production activities as logical steps in providing for future activity in the area.

2. The no discharge limitation of the General Permit. 29-1

   Discussion: This limitation does not provide for alternatives accepted in other activities such as in treated sewage effluent or uncontaminated rainwater runoff.

3. The no dredging limitation of the General Permit.

   Discussion: In the context of the other limiting conditions of the General Permit, this restriction does not appear necessary.

RESPONSE TO COMMENTS

29-1. As stated in response to similar comments from others, recommended revisions to the proposed General Permit are contained in Chapter 13 of the FGEIS. Further studies are considered necessary for the Mobile Delta and the cooperating agencies are in the process of initiating these efforts. Also see responses to comments 23-2, 23a-320 and 23a-321.

Consideration is not given for relatively minor dredging operations, with insignificant impact potential, that are likely to be necessary in water depths between six and eight feet.

4. The separation/distance limits which are more limiting than existing state practices. 29-1 cont.

Discussion: It would appear that a General Permit should reflect practices acceptable to the state(s), in order to optimize the potential benefit to all concerned.

5. The lack of balance in the DGEIS.

Discussion: After very careful study of the DGEIS, a reader will conclude that the operations reviewed will have insignificant long-term negative impact. However, the casual reader or a reader somewhat apprehensive of the activities will tend to be overwhelmed by what appears to be the absolute certainty of major negative impact, with essentially no offsetting positive impact. With this type of impression prevalent, it is difficult to see how the general public can obtain a true concept of the facts. 29-2

In conclusion, we would express our appreciation to the Corps and the other agencies which obviously were diligent in their efforts to formulate such a comprehensive document as the DGEIS.

We will continue to work with the MOGA group and/or the Corps, as necessary, to assist in finalizing these documents or developing general permits for future work.

Yours very truly,

Frank B. Balke

Frank B. Balke

RESPONSE TO COMMENTS

29-2. While you offer no comments on specific sections of the GEIS, similar detailed comments were submitted by the Mid-Continent Oil and Gas Association. We refer you to responses to their comments. Some portions of the GEIS have been modified to discuss certain impacts in the appropriate sections, such as under the heading of accidents as opposed to routine operations, and the significance of certain impacts has been clarified to better balance these discussions.

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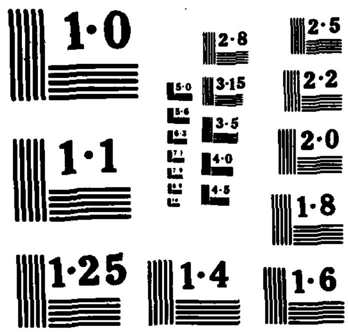
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